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July 2012

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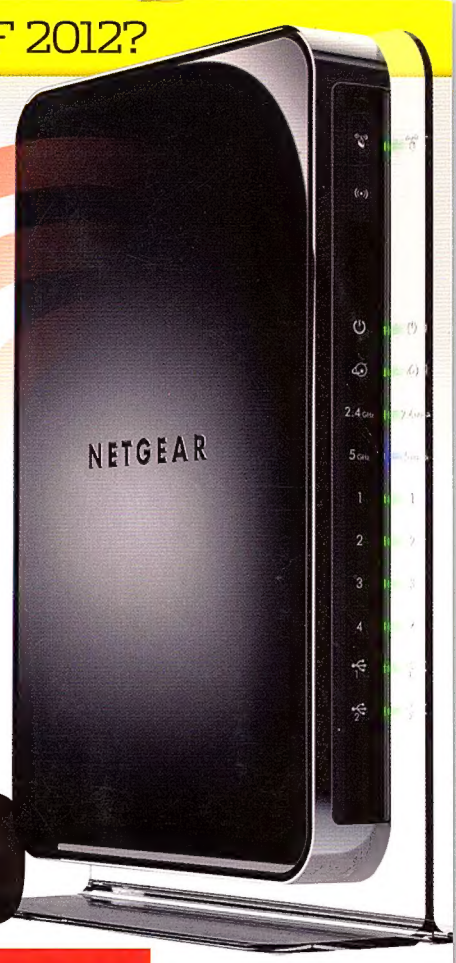

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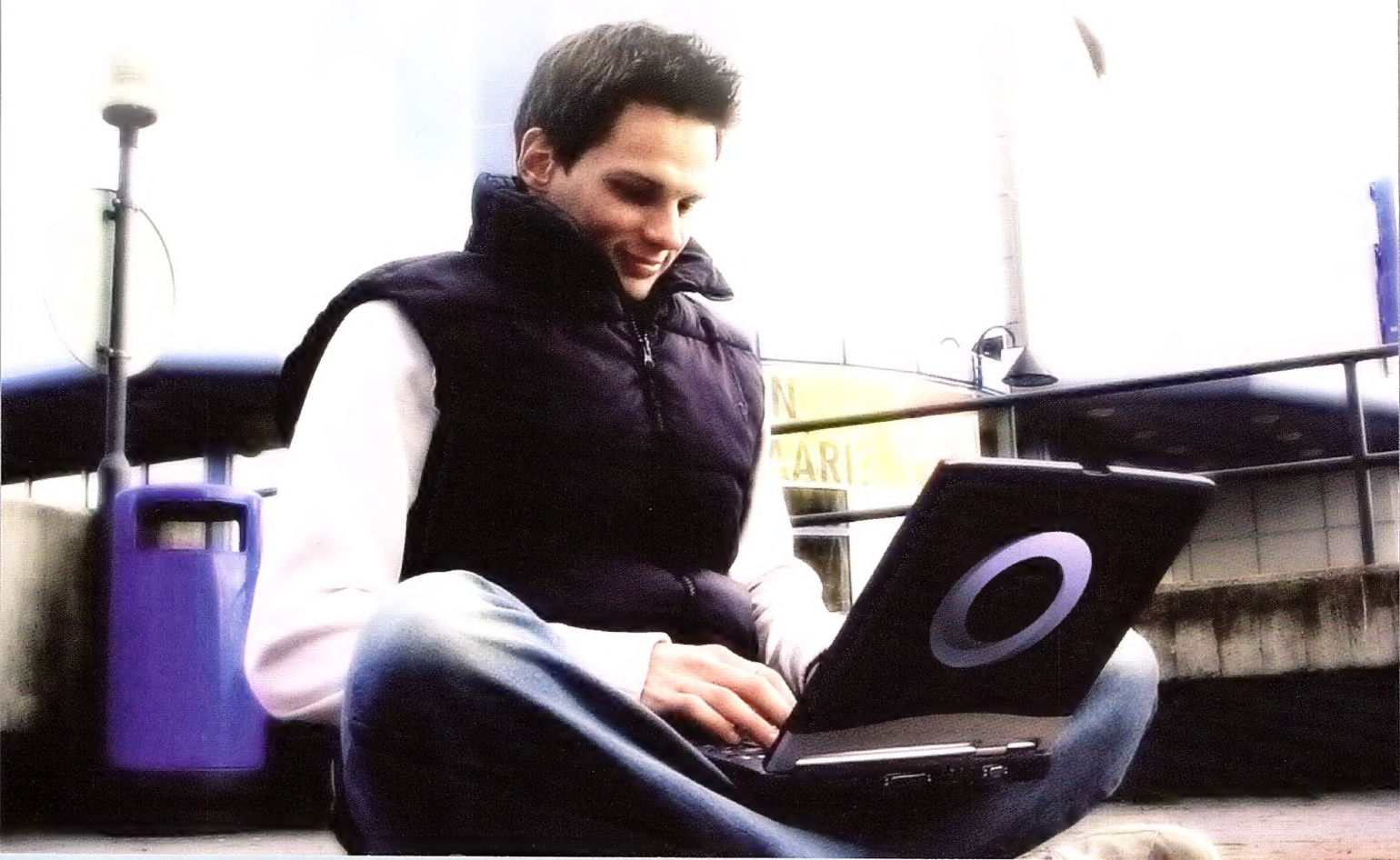

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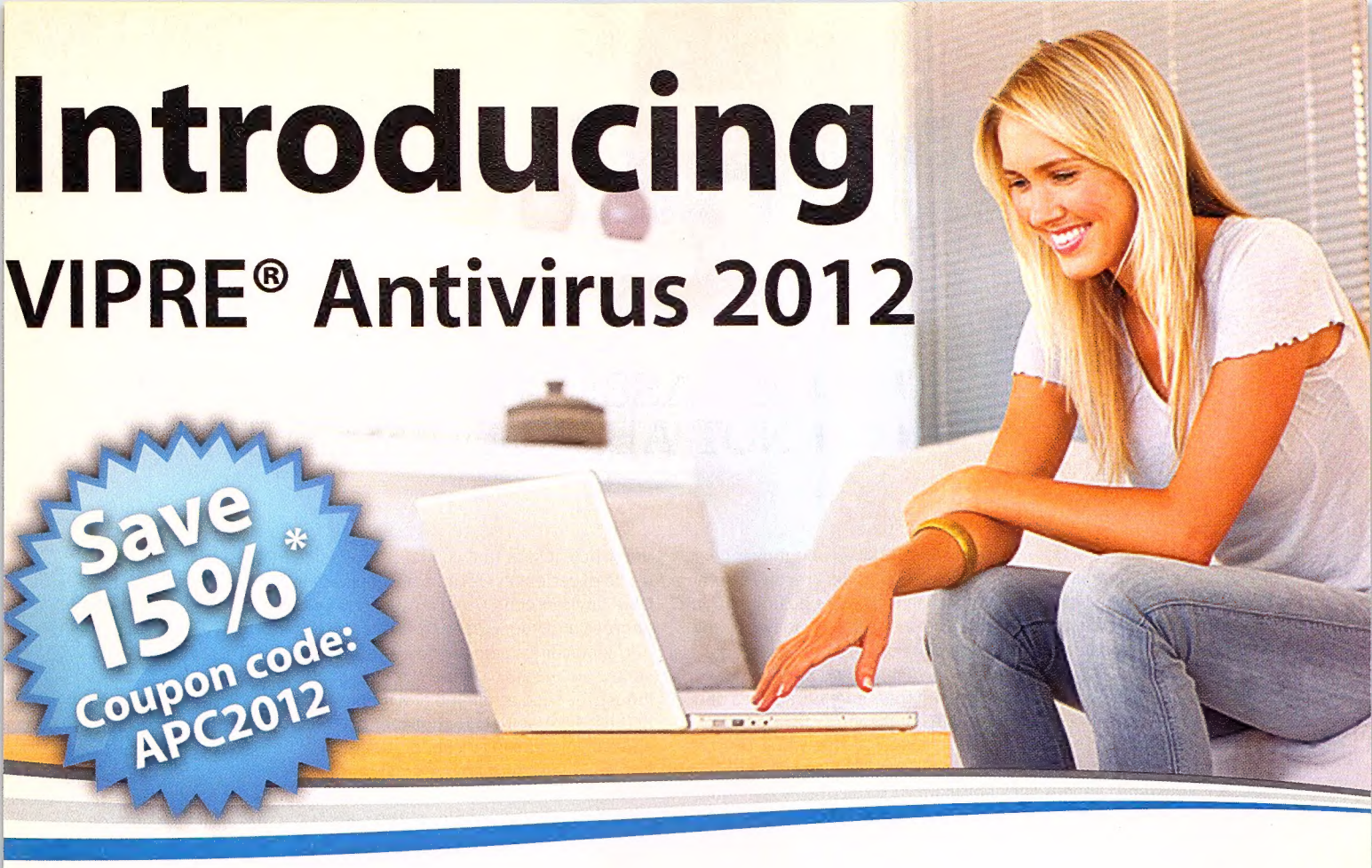

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06 editorial

TONY SARNO

I CAN ASSURE YOU THAT *APC* IS NOT ABANDONING THE MAC

Following my editorial last month in which I talked about change at *APC* following the relaunch of *PC User* as *TechLife*, I received some emails from readers who were concerned that we're positioning *APC* as a Wintel magazine, focused entirely on PCs and Windows 8, and leaving *TechLife* to do all the fun stuff, including Apple coverage.

The reader reaction has been quite enlightening about the importance of the Apple environment in their computing lives and shows how far the iPhone and iPad have pushed Apple into every area of computing. The point readers made was that while *TechLife* is the obvious magazine for all things iPhone, iPod and iPad because of their consumer appeal, they still want *APC* to cover Apple. Macs might not be their main or preferred computing platform, but it's clear that it's unavoidable and they want to know about it.

One reader wrote: "I consider myself to be an OS agnostic of many years standing... in my field of employment, I also come across many businesses that run Macs alongside PCs. So from my real-world experiences, serious businesses also employ Macs with their OS X environment. Go to any university running computer science degrees and you will see that Mac laptops make up a third or more of the machines being used by students and lecturers alike. The same can be said of industries ranging from architecture to heavy industries such as mining and manufacturing. The presence of Apple in these diverse fields is not the result of some freakish accident. So you can imagine my disappointment in reading that your magazine has decided to turn its back on Macs."

Well, I can assure you that *APC* is not abandoning the Mac. Far from it. With *TechLife* now in the newsstand, *APC* will focus on the core technologies that drive computing and you'd have to say, the Apple Mac and its army of consumer products is one of them.

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1. TBR Report - "IBM System x® x86 servers: Meeting the demands of today's enterprises by combining value and support" January 2012. 2. Source: Intel Performance comparison using SPECfp*_rate_base2006 benchmark. Baseline score of 267 on prior generation 2S Intel® Xeon® processor X5690 (3.46 GHz, 6 core, 12MB L3, 6.4 GT/s, 130W) based platform published at www.spec.org as of 6 Sept 2011. Estimated new score of 486 on 2S Intel® Xeon® processor E5-2690 (2.90 GHz, 8 core, 20MB L3, 8.0 GT/s, 135W) based platform is based on Intel internal measured estimates as of 6 Sept 2011 using two Intel® Xeon® processor E5-2690, Turbo Enabled, EIST Enabled, Hyper-Threading Enabled, 64 GB memory (8 x 8GB DDR3-1600), Red Hat* Enterprise Linux Server 6.1 beta for x86_6, Intel® Compiler 12.1.3..x3650 M4 supports up to 768GB of memory using 32GB LRDIMMs in it 24 memory slots. Previous generation x3650 M3 supports up to 192GB of memory. 4. Ships with 4 1Gb Ethernet ports standard and supports integrated slot-less 10Gb Ethernet with Virtual Fabric. Previous generation server includes 2 1Gb Ethernet slots and requires use of a PCI Express slot to support 10Gb Ethernet. 5. Global Financing offerings are provided through IBM Credit LLC in the United States and other IBM subsidiaries and divisions worldwide to qualified commercial and government customers. Monthly payments provided are for planning purposes only and may vary based on your credit and other factors. Lease offer provided is based on a FMV lease of 36 monthly payments. Other restrictions may apply. Rates and offerings are subject to change, extension or withdrawal without notice. IBM hardware products are manufactured from new parts or new and serviceable used parts. Regardless, our warranty terms apply. For a copy of applicable product warranties, visit http://www.ibm.com/servers/support/machine_warranties. IBM makes no representation or warranty regarding third-party products or services. IBM, the IBM logo, Express and System x are registered trademarks of International Business Machines Corporation registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. For a current list of IBM trademarks, see www.ibm.com/legal/copytrade.shtml. Intel, the Intel logo, Xeon and Xeon Inside are trademarks of Intel Corporation in the U.S. and other countries. All prices are subject to change without notice, may vary according to configuration, are based upon IBM's estimated retail selling prices as of 16/04/12 and may not include storage, hard drive, operating system or other features. Reseller prices and savings to end users may vary. Products are subject to availability. © Copyright IBM Australia Limited 2012. ABN 79 000 024 733. © Copyright IBM Corporation 2012. All rights reserved.

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EVOLUTION

THE FIRST BIG GAMING ULTRABOOK

Acer's Timeline M3 is the first ultrabook with a serious graphics card in it.

BF3 payable at over 30fps on Medium? Sure, why not?

Ultrabooks have come a long way since 2011. The first ones to come up for sale were sleek little things with small screens and a tiny weight. Fast forward to 2012, and Acer's Aspire Timeline Ultra M3 is a beefy ultrabook with a 15.6in screen and specs almost like a traditional all-rounder, including a DVD burner and a powerful Nvidia GeForce GT 640M dedicated graphics card.

Can the M3 seriously be considered an ultrabook? Absolutely. Despite having specs that wouldn't look out of place in an all-rounder (low-voltage processor aside) the M3 weighs just under 2.1kg and is only 20mm thick, which squeeze it into the ultrabook spec. That makes it nearly 0.5kg lighter and nearly half as thick as traditional all-rounders.

While it won't win awards for its plastic build and uninspiring design, it does have what we geeks love: real guts inside. Powering it are an Intel Core i7 CPU, while the GeForce GT 640M is one of the new Kepler graphics cards (deliver more performance than the equivalent cards based on the previous Fermi architecture, but use less power). The combination means that the M3 delivers the graphics performance of a PC with a mid-range graphics card, which is another way of saying it will run most intensive PC games at Mid to High levels of detail. Smaller ultrabooks showed us that small notebooks don't have to be weak, and now larger ultrabooks are showing us that big notebooks don't have to be heavy.

Conrad Bem

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TOP 5
WINDOWS 8 CHANGES FROM BETA

01 BETTER CORNERS
Screen corners replacing Start button made more mouse-sensitive.

02 BUILT-IN BOOT
Win 8 boots too fast for function key press – so boot menu option included in general settings.

03 AERO IS GONE
No more transparent frames and gradients.

04 MORE APPS
More built-in Metro apps to be included.

05 BUILT-IN MONITORING
Parents can monitor children's activities on the computer.

PERFORMANCE OF PC, SIMPLICITY OF CONSOLE

Nvidia's new GeForce Experience technology wants to make playing a PC game as easy as a console game, but with PC visuals.

With the objective of allowing you to 'enjoy the game at its fullest', Nvidia has released a beta (on June 6) for the GeForce Experience (GFE), a cloud-based games optimiser, which tries to tailor your game's settings for your specific machine.

If it lives up to its promise, GFE is a significant game changing event that will help everyone from average gamers to enthusiasts get more from their games. That's because even the most tech-aware of gamers may not know exactly what each of the myriad settings presented in any given game will do to performance and visuals, or have the time to figure it out. As a result, a great proportion of games are played at their default settings, which means they're not optimised for the particular PC they're being played on.

The reason for the mass of settings in a PC game is because of the huge breadth of the platform. The PC gaming platform covers a massive range of performance, with a 50x difference between the lowest notebook with a discrete GeForce GPU to a top-end, quad-SLI desktop behemoth. As Jen-Hsun Huang, Nvidia's big boss puts it, that makes for "mind-numbing complexity for developers". There are hundreds of thousands of different PC configurations, from different GPUs, different CPUs, motherboards, operating systems and drivers. Add the different games and engines and that's a frightening number of combinations.

Behind GFE is a cloud data centre with a supercomputer that crunches these configurations. This connects to a desktop application that sits between the cloud and the OS and the games you have installed. For each title, the GFE app will ensure that the latest available GPU driver is in operation and has the best possible settings.

Once the app has chosen the 'perfect' settings, it will then automatically load them in-game as soon as you launch it. It's a neat solution and will cement Nvidia in the minds of the PC gaming community even more. It's another reason to opt for the green side of the graphics divide in the gaming GPU war. How will AMD compete? Can it?

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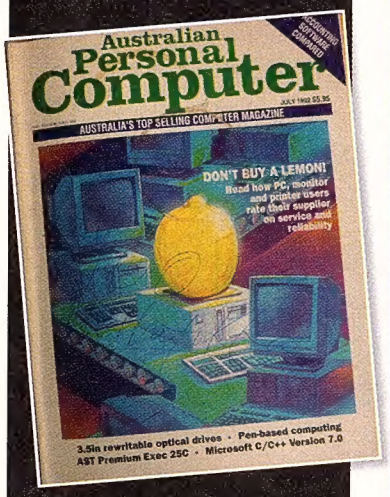
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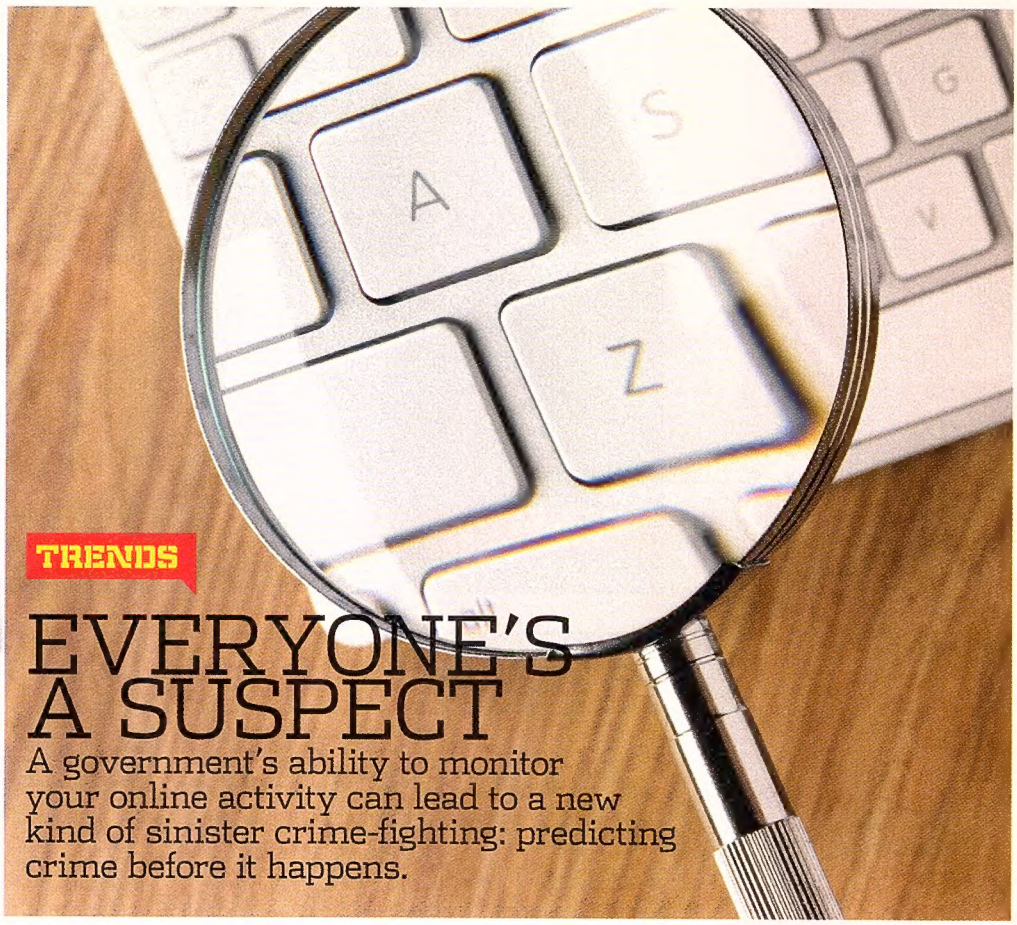
APPLE BUILDING UP NEWTON

Apple's John Sculley last month demonstrated a prototype of Apple's Personal Digital Assistant (PDA), a product he hopes will grab a significant slice of what he claimed would be a three trillion dollar market by the turn of the century.

Called Newton, after the name of the multitasking operating system it runs, the Apple PDA is differentiated from the current crop of handheld personal computers by the ability to recognise handwriting from a pen-based input device.

COMPAQ FULFILLS PROMISE OF LOW COST PCS

The industry has been waiting in anticipation of Compaq's new range, which includes 13 new PC workstations and laptops. The entry level desktop in the range is the Pro Linea, which is ideally suited to individual and small business users. Included in this line is a 486DX which features 4MB of RAM (expandable to a massive 16MB), and an 80, 120 and 210MB hard disk drive. The highly affordable 4/33 costs between $3,214 and $3,904, depending on configuration.



TRENDS

EVERYONE'S A SUSPECT

A government's ability to monitor your online activity can lead to a new kind of sinister crime-fighting: predicting crime before it happens.

Under the guise of wanting to prevent terrorism, Western governments everywhere are doing all they possibly can to garner the ability to monitor your web activity, down to the content of your emails or Skype conversations, even if you aren't suspected of a crime.

Once the authorities have the data, it will be all too easy for police forces to claim that such in-depth and vast amounts of intelligence make it far easier to fight crime before happens, according to privacy experts.

The trend is on toward deeper monitoring of a country's citizens. For instance, in Australia a requirement that telcos log and retain the web history of your PC, smartphone or tablet is being proposed for discussion through public hearings as part of a Federal Government review of national security legislation.

Currently, monitoring plans are being proposed in the UK to give authorities easier and deeper access to internet logged data. The UK government's Communications Capabilities Development Programme (CCDP) is likely to involve a technology known as Deep Packet Inspection, which uses automated systems to scan data and identify what the information is and where it's going.

Deep Packet Inspection is already used by the FBI and NSA to intercept some communications, and OpenNet says that if reports are correct, the US has "the world's most sophisticated internet surveillance regime". The proposed Cyber Intelligence Sharing and Protection Act (CISPA) could compel private companies to share user data with law enforcement, block web sites and disrupt privacy tools such as Tor.

Jim Killock, the director of the Open Rights Group (**www.openrightsgroup.org**), is worried about the developments. "Social media and sites such as Google have a huge amount of information about us, and that information is very revealing and potentially harmful. We believe that access to that information should come from a court, not through self-authorisation."

As Andrew Lewman, director of privacy service Tor, told a newspaper: "Once the data is collected, regardless of the current intentions, it will be used for all sorts of reasons over time. The number of crimes will expand to include all sorts of petty issues, political repression and restrictions on speech. Eventually someone will think they can predict crime before it happens."

That isn't as far-fetched as it sounds. As Killock told us, the proposed new legislation changes the way surveillance is used against people. "It assumes everyone is a suspect," he concludes. apc

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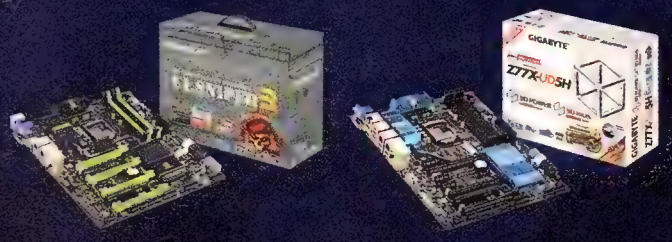

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12 gadgets

BY ANNA FINNERTY

$150

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ONLINE theperegrine.com

The Peregrine

You know what it's like – it's late at night and you're fighting some orcs or casting a few spells and the last thing you want is to be fumbling around with your keyboard in the dark. Enter the Peregrine, a slick-looking glove that replaces the keyboard for a supposedly more organic gaming experience. Programmable sensors on the glove let you define up to 30 actions, so you can control a game just by touching various points. We also like that the Peregrine is well ventilated – a must for prolonged gaming sessions. And should the glove get grimy, it's also washable.

CONTACT Hex3
ONLINE
www.hex3.co

$50

Hex3 AppTag Laser Blaster

I can't wait to aim one of these Laser Blasters at my man's head and chase him around the house. Is that so wrong? Used in conjunction with your smartphone (Apple or Android), this unassuming toy blaster becomes a weapon in a real-life console game. By downloading the AppTag app, you can enjoy a laser shooting session with benefits: grab ammo packs, health kits, body armour and the like. The blaster communicates with your phone via high-frequency sound, so you don't have to fiddle around with Bluetooth or Wi-Fi connections.

$700

CONTACT Bang & Olufsen
ONLINE
www.beoplay.com

Bang & Olufsen BeoPlay A3

I'd love to say I own a Bang & Olufsen hi-fi system, but sadly, even this iPad speaker is beyond my means. As you'd expect from this exclusive brand, the BeoPlay A3 is beautifully designed – sleek, modern and expensive-looking. It's driven by three 0.5in tweeters and a 2in subwoofer, which isn't bad for a unit this size. The wedge shape means it doubles as a stand, and you can lie it down or sit it up on its side. It knows how you've placed it and it chooses which speakers to activate for the best-sounding audio.

Garmin Approach S3

Serious golfers (and amateurs who like to look the part) take note – the new Approach S3 is a GPS watch that holds all you need to know about your favourite golf courses. The watch comes preloaded with information about a whopping 27,000 courses around the world and it's updated regularly throughout the year. The 'Green View' feature shows an image of the course. It tells you where you are, allows you to adjust pin placement and always shows your distance from the pin. The watch also works as a round timer and keeps track of player scores.

CONTACT Garmin
ONLINE
www.garmin.com/golf

Sony Cyber-shot DSCHX20

I love technology, but sometimes I want to forget about the tech behind a product. Sometimes I want a product that will do what it needs to do on autopilot. That's why I like the sound of the new flagship Cyber-shot. It's a point-and-click camera, so you can take photos without too much fiddling, but it's big on features: a 20x zoom, 18.2MP sensor, optical image stabilisation, a GPS and compass in order to tag the shots you take, and it even records 1080p Full HD video. It might be a while before I dust off the old DSLR.

CONTACT Sony
ONLINE
www.sony.com.au

Keystone ECO MarineCase

There have been many occasions where I wished my phone were waterproof: the kids' first swimming lesson, scuba diving in Phuket... and when I accidentally dropped my phone down the loo. The silicone MarineCase would have been a handy accessory to own. It keeps your iPhone 4/4S safe and fully functional, so you can take calls, text, use the internet or your apps 6m below the water's surface. So the next time you want to play *Words with Friends* while you're out for a swim, you're covered.

$40

CONTACT
Concord Keystone
ONLINE
www.concordkeystone.com

IT ALL

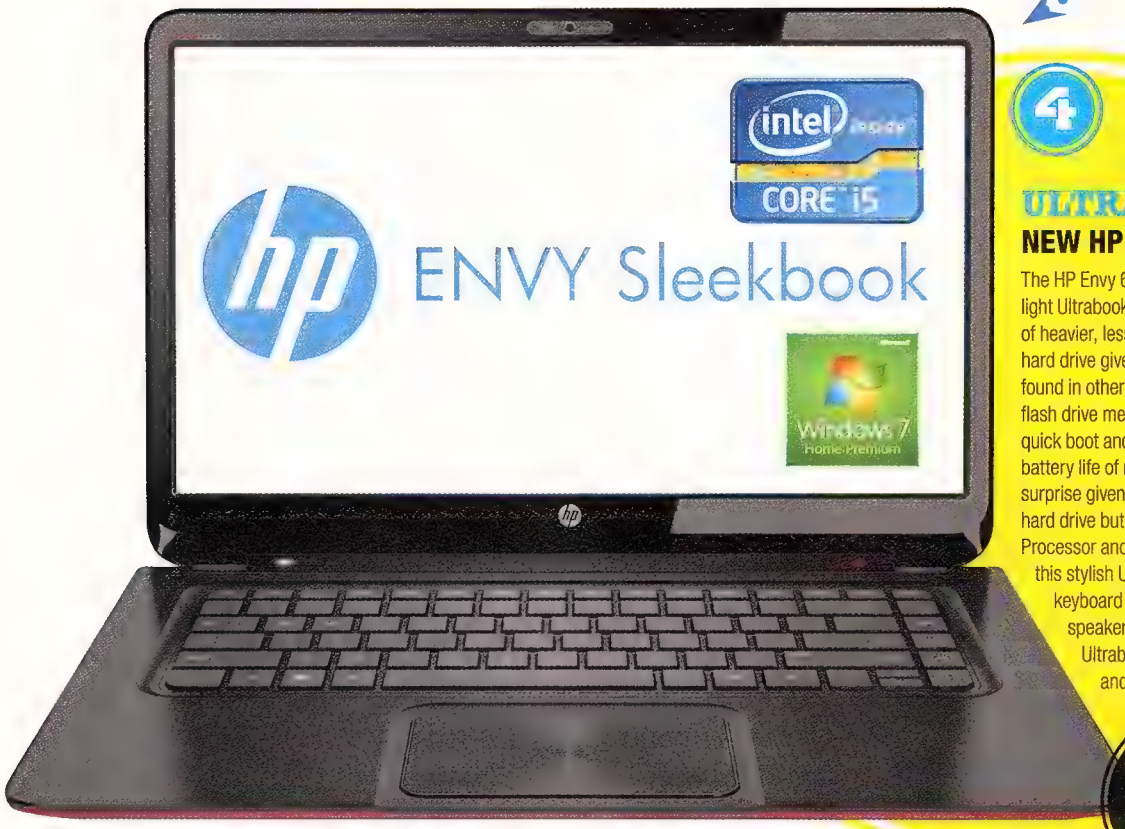
MULTIFUNCTION PRINTER

3

Epson Artisan 730 Multifunction

The Epson Artisan 730 Multifunction is one of the most versatile multifunction printers on the market because it combines advanced performance and photo management with high-definition printing. The printer's 40 page per minute speed (both colour and mono) makes it one of the fastest multifunctions on the market, while its 120 sheet capacity, 2-sided printing and Epson iPrint, print-from-anywhere feature, provides convenience and cost-savings. It can print at a very high resolution of 5,760 x 1,440 DPI and offers six individual ink cartridges. Photo enthusiasts can print photos directly from a camera's memory card via the PictBridge interface or scan photos at high 2,400 x 4,800 dpi resolution. Plus, the printer's ability to use Epson Claria Photographic ink means it delivers the most stunning photo prints.

$149



4

ULTRABOOK

NEW HP Envy 6 Ultrabook

The HP Envy 6 is a 15.6 inch ultra-slim and light Ultrabook with many of the advantages of heavier, less portable notebooks. Its 500GB hard drive gives you far more storage than usually found in other Ultrabooks, while its internal 32GB flash drive means the HP Envy 6 still delivers the quick boot and resume expected of an Ultrabook. Its battery life of nearly nine hours is another pleasant surprise given the HP Envy 6 packs not just a 500GB hard drive but a powerful 1.6GHz Intel Core i5 Processor and 4GB of RAM. And on the outside of this stylish Ultrabook, we love the excellent backlit keyboard and the sound from the Beats Audio speakers. In short, this is a great all-round Ultrabook, suitable for both personal and business use.

$1199

To find out more about any of the products featured or to browse a huge range of technology and accessories, jump online and visit

officeworks.com.au

STARTS HERE

Any modern home should have a wireless network that's able to stream, transfer and back up data among several wireless devices. But if it's an *APC* reader's home, we expect the occupants to be pushing the limits, sharing HD videos, doing lots of multiplayer gaming and downloading lots of giant files at the same time. So for an *APC* home, it all starts with a high-performance modem router that will take an internet connection and share it with other devices in the home.

1

ROUTER

Netgear DGND3700 N600 Wireless Dual Band Gigabit Modem Router

If you expect your home wireless network to deliver the highest performance you need a premium router that can stream HD video and support multiplayer gaming. The NETGEAR N600 Wireless Dual Band Gigabit ADSL2+ Modem Router is the ultimate high-performance networking gateway between your home and the internet. With concurrent dual band technology (802.11 a/b/g/n 2.4 or 5.0GHz) it delivers the fastest streaming and gaming as well as multiple downloads. The built-in DSL modem is compatible with all major DSL Internet service providers while a broadband usage meter monitors internet traffic and sends customised reports to help keep costs under control. Two USB ports let you add external USB storage and the router runs with Windows, Mac OS X or Linux.

$239

2

$199

NETWORK DRIVE

Western Digital 1TB My Book Live Personal Cloud Storage

The Western Digital 1TB My Book Live Personal Cloud Storage sits on this network as the storage and backup hub for all your data and entertainment files. Compatible with all DLNA or UPnP devices it can form the basis of your own personal cloud, letting you access your files at home or away with your Mac, PC, smartphone and tablet. Its streaming capability lets you stream videos, music, and photos to your connected TV, game console or media player. All you need to do is connect the My Book Live Personal Cloud Storage to your wireless router and you have a complete storage and streaming solution. A built-in, high-powered CPU means the drive can handle the most demanding streaming and transferring of large files.

Officeworks

QUICK SYNC

INTEL'S SECRET WEAPON

Why Intel's Quick Sync Video transcoding engine is the best-kept secret of Ivy Bridge.

It's time to start taking Intel Quick Sync Video technology seriously. Quick Sync, of course, is the hardware-accelerated video transcoding engine that comes free of charge with every chip it makes for the LGA 1155 socket. And by some metrics it's the most exciting piece of hardware currently available for desktop PCs, a revelation that comes to you courtesy of various third-party testing with Intel's latest Ivy Bridge processors. In the tests, one aspect of the new Ivy Bridge processors that was genuinely fun to observe was the Quick Sync Video core doing its video munching thing.

You can read the full benchmark details opposite, but try this for starters. With Quick Sync, you can transcode an hour-long Full HD episode of *Game of Thrones*, for example, and convert it to fit on a smartphone or a tablet. And you can do this entire process in just a few minutes.

Do the same job using the CPU cores of the very fastest Ivy Bridge processor and you can expect to wait for 10 minutes or more. If you have an older CPU, it might take two or three times longer again.

There's actually a broader lesson here and it goes something like this: the future of computer processing doesn't necessarily involve an endless progression of CPU cores or ever crazier clock speeds. Instead, it's likely that the extra transistor budget that comes with die shrinks will be used to deliver special or fixed-function hardware designed for specific tasks.

The Quick Sync is technology that first appeared in the Sandy Bridge family of chips and the basic idea has remained largely the same. Take the highly parallelised graphics processing power of the integrated video core that Intel now fits to all of its mainstream PC processors, and add a little fixed-function hardware to create an awesome video creation machine.

As for the details, Intel starts with a hardware decode engine. This is the real, full-feature deal, decoding the entire pipeline in hardware. As every good computing enthusiast knows, dedicated hardware will do things much, much faster than general-purpose computing techniques, such as a CPU core using software algorithms to do the same job.

Another upside is power efficiency. Fixed-function circuits are much smaller and less power-hungry than non-fixed, which makes them ideal for mobile applications. Hold that thought for now – we'll be coming back to that in a moment.

OPTIMISED FOR QUICK SYNC

Arcsoft MediaConverter, ShowBiz & TotalMedia Theater
Badaboom Media Converter
Corel Digital Studio
CyberLink Media Espresso, MediaShow, PowerDirector & YouCam
Daum Pot Encoder
GOM Video Converter
GoPro CineForm Studio
MAGIX Video Pro X4
MainConcept
Nero 11
Roxio
Tencent QQ

THE GPU ALTERNATIVE

General-purpose computing on the GPU has long been promised as the saviour of PC performance. We're doubtful it will happen. At least, it looks unlikely to happen the way graphics specialists, including Nvidia, have been claiming.

As it happens, video encoding and transcoding are the poster apps for running non-games software on PC video cards. Therefore it's significant that even the latest and greatest GPUs are beaten silly by the puny graphics integrated core that Intel slips inside its CPUs and the Quick Sync feature it comes with.

Put simply, Intel's Quick Sync is better optimised for video transcoding. It all points to a future for video encoding that doesn't involve brute-forcing the job on massive 3D shader arrays. Instead, it will be all about hardware acceleration and architectural optimisations.

Of course, depending on your current CPU and GPU, the latter may still be faster for encoding video. But if you're running a Sandy Bridge or Ivy Bridge-generation Intel CPU and you're not using Quick Sync, we highly recommend you give it a try. It's stunning in action. If you haven't got one of those CPUs and you do a lot of video crunching, it's time for an upgrade.

BENCHMARKS

Quick Sync is stupidly quick at video encoding. It's four times faster than the best Intel LGA1155 CPU. It even gives the Nvidia GeForce GTX 680 a good spanking. It's also intriguing to see Quick Sync in an ultrabook with a low-voltage Sandy Bridge CPU. If there's a disappointment, it's that Quick Sync in its latest Ivy Bridge form only delivers slightly better performance than the Sandy Bridge vintage in our testing. According to Intel's Dave Salvator, much depends on the workloads in question. The higher the bit rate of the output file, the bigger the gap between Quick Sync as it was and now is. Given that our test workload involves creating low bit rate content for viewing on smartphones, that makes sense.

COMPRESS HD 720P HIGH BIT RATE VIDEO TO DVD QUALITY FOR SMARTPHONES

The downside to all of this is reduced flexibility. For starters, Quick Sync makes supporting new video codecs quite difficult. If you were using pure hardware to encode, it would also place limitations on the sorts of settings and parameters you could use. For that reason, Intel takes a different approach when it comes to the encoding part of the equation.

Here, the job is shared between the fixed-function engine and the shaders inside the graphics core. It's a fairly complex arrangement, but the main job handled by the fixed-function engine is applying cosine transform to the pixels, while the shader array handles motion transfer, which is usually the most computationally demanding part of the process.

QUICK ENCODER

As you can see from the benchmarks, the results are seriously impressive. In our tests, Quick Sync is around four times faster than encoding on the CPU cores of the Core i7-3770K, which is a very fast processor. Compared to, say, a two- or three-year-old dual-core CPU, the difference would be monumental.

Just as striking is the fact that Intel's Quick Sync Video technology manages to overshadow discrete GPUs from both Nvidia and AMD when it comes to video transcoding. Clearly, Nvidia isn't making the most of the raw power offered by the 1,536 shader cores in its GeForce GTX 680.

For the second iteration of Quick Sync, Intel has given the fixed-function decoder engine a polish to improve performance. But more significant are changes to the graphics shader cores. The most powerful version of the integrated core, known as HD Graphics 4000, has an extra four cores for a grand total of 16. What's more, each core is more complex, in part because it now supports DirectX 11. Overall, there's significantly more compute power on offer.

If all that sounds great, there's at least one major proviso: Quick Sync needs full application support to do its video-crunching magic. That's the big difference with general-purpose CPU cores. They'll run most things you throw at them.

The list of major applications that support Quick Sync was pitiful at launch, but has been gradually growing (see the list opposite). Notably, however, the encoding software is largely restricted to consumer rather than professional apps.

POP VIDEO

According to Dave Salvator, Intel's bigwig for all things graphics-related, that's because hardcore video editors "still prefer to use software. They see it as an image quality thing." For now then, Quick Sync isn't quite flexible enough to win over the professional video production industry.

Then again, perhaps that's just as well. When you see how fast Quick Sync tears through video transcoding jobs, you have to wonder how much sense it makes to buy an expensive Intel CPU and do the work in software. Oh, and for the record, we found the output quality of Quick Sync to be easily good enough for use on both portable devices and home cinema, even if currently it's probably not up to the job of authoring Blu-ray discs.

It's worth noting that Quick Sync can also be used to transcode video on the fly for streaming content wirelessly to displays and mobile devices, or even for a little HD video conferencing. What's really tantalising, however, is the thought of Quick Sync in those sleek ultra-mobile devices. Could we see it making its way into Atom? Salvator isn't going to spill the beans just yet. "All I can tell you right now is that it's possible," he says. At the very least, it's obvious he thinks the idea is intriguing. APC

Badaboom supports CUDA and Quick Sync acceleration for faster encoding.

Anyone transcoding video really should get their hands on a Quick Sync CPU.

COMPUTING'S REAL ARMS RACE

The ShenWei CPU may have been reverse-engineered from the DEC Alpha.

Billions are being spent on building computers you and I never use, but they have the power to reshape science, technology and society, reports Jamie Middleton.

They can dramatically reduce research time, accurately simulate and model real-life systems, and help design products perfectly suited for their environment. Supercomputers are at the forefront of technology that's already changing the world.

It was therefore big news when China's Tianhe-1A, based at the National Supercomputer Centre in Tianjin, took the supercomputing crown from America's Jaguar system at Oak Ridge National Laboratory in November 2010. For years the US enjoyed its status as the leader in the field and despite losing the top spot, it could take some solace from the fact that the Tianhe-1A was built from US tech; specifically, Nvidia GPUs. That all changed when Japan knocked the US down to third place in July 2011 with its K Computer, built from Fujitsu's SPARC64 VIIIfx processors. With its 864 server racks and 88,000 CPUs, the K achieved a LINPACK benchmark of 10.51 petaflops.

A POWER SHIFT

In October 2011, the rules changed again when China announced its newest supercomputer, the Sunway BlueLight MPP. Not because it was the most powerful – it's thought to be the 15th fastest machine in the world – but because it was built entirely from Chinese-made processors, making it the first Chinese supercomputer that doesn't use Intel or AMD chips. The Sunway realises China's dream to sever its reliance on US technology. This isn't just rhetoric, but a stated ambition of the Chinese government. What's more, the Sunway's small size and relative energy efficiency compared to other supercomputers in the top 20 have surprised top computer scientists. Some commentators believe this is a sign that China is about to leapfrog its competitors with the next iterations of its own technology.

The Sunway BlueLight MPP is built from ShenWei SW-3 1600 chips (16-core, 64-bit MIPS-compatible (RISC) CPUs) that are thought to be a few generations behind Intel's current chips, but with the large funding base provided by the Chinese government, it's unlikely that new versions of these chips are far away. ShenWei CPUs are believed to be based on China's Loongson/Godson architecture, which China has been working on since 2001. Some believe this family of chips was reverse-engineered from the US-made DEC Alpha CPU. This may be true, but the nice thing about reverse-engineering products is that it allows you to apply hindsight – to redesign and remove all those hangovers and unnecessary artefacts from previous iterations – hence their better energy efficiency and smaller size.

China's ingenuity has been followed by countries all over the world. You can build a supercomputer from SSDs, so why not make one from mobile phone chips? By using low-powered Tegra CPUs, typically found in mobile phones and tablets, the Barcelona Supercomputer Centre in Spain hopes to reduce the amount of electricity needed to run its new supercomputer. There's a deal with Nvidia in the offing and it hopes to produce a high-performance computer by 2014 that runs with a four- to tenfold improvement in energy efficiency over the most energy-efficient models now.

How about building a cloud-based virtual supercomputer from the servers you have lying around idle? Servers that could be used as a supercomputer today

Japan's K Computer has the same power as a million desktop PCs and cost an estimated $1.46 billion to develop.

Using low-power processors, such as Nvidia's Tegra 3, is one method of increasing the energy efficiency of new supercomputers.

and something else tomorrow. A supercomputer for hire, if you will. Amazon did just that in the autumn of 2011, building a virtual supercomputer out of its Elastic Compute Cloud (Amazon EC2), the worldwide network of data centres it uses to provide cloud computing power to other businesses across the world.

However, these are just ways of employing technologies that already exist in a commercial form. The truly exciting research is based on technologies only just being tested in the lab. It's in the development sphere that various technology buzzwords and phrases are bandied about, all of which could lay the foundation for the next generation of supercomputing. These include developments, such as optical information processing, atomic-scale silicon wires and quantum computing. It's these technologies that will lead to the next big leap: exascale computing.

EVEN FASTER

Exascale computing is a big dream in the supercomputing world: producing a machine with 1,000 times the processing power of the fastest crop of supercomputers.

Most pundits are predicting the breakthrough by the end of the decade, but there are various real-world constraints that need to be overcome first. Technically there's nothing stopping someone assembling the hardware to create an exascale computer today. The problems are how much power it would consume, its mammoth size and the heat it would produce. Even today's high-performance computers would melt in minutes if you took away the cooling fans used in their ice-cold bunkers.

China's Sunway BlueLight MPP computer is leading the way in energy efficiency. Its power requirement is 1MW. In comparison, its predecessor, the Tianhe, built using US technology, consumes 4MW when running and America's Jaguar around 7MW. That's a considerable saving in both power and running costs for a machine that's about 74% as fast as the Jaguar, when you consider that each megawatt means about a million dollars a year in electricity costs.

Running Japan's K computer at its July peak of 8.162petaflops took 9.89MW. That's roughly $10 million a year. The leap to exascale may seem a big one to make by 2020, but it'll be needed to wade through all the data that will be stored by then. Eight years ago there was only about five exabytes of data online. In 2009, that much data was going through the internet in a month.

Currently, the estimates stand at about 21 exabytes a month. That's not to mention all the sources of data stored elsewhere, all ripe for analysis – shop loyalty cards, CCTV footage, credit card data, information from weather tracking satellites, tidal flows, river drainage and star mapping, to name but a few. Data is generated and stored everywhere, producing endless seas of statistics to wade through.

To find better ways to achieve better data speeds or more energy-efficient supercomputers, research centres are starting to build them out of more unusual components. The San Diego Supercomputer Center (SDSC) has built one that uses flash storage (1,024 Intel 710 Series drives), so it can access data up to 10 times faster than traditional hard drives. At its unveiling in January, Michael Norman, the director of the SDSC, said: "It has 300 trillion bytes of flash memory, making it the largest thumb drive in the world". It's a powerful thumb drive, ranking 48th on the TOP500 (**www.top500.org**). In case you're wondering, the computer is called Gordon. Yes that's right, Flash Gordon. abc

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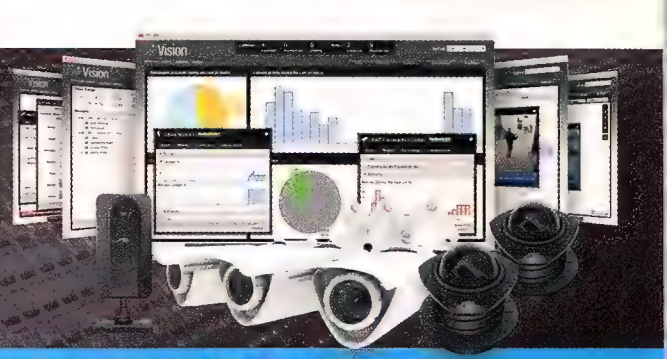

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HAVE YOUR SAY

USB BEATS CLOUD

The cloud is getting plenty of hype in APC and other magazines recently. It might be useful if we had fast internet connections available everywhere, but we don't.

I work in many places where the PCs do not have internet access or where wireless internet access on my laptop is unavailable (for example, hospitals because of interference it causes to other equipment).

The solution? Nothing beats the USB flash drive. It's attached to my keys and goes everywhere with me (and I don't have to carry around my laptop). With 64GB USB drives now available you can carry almost all of your documents with you.

So with my USB drive, I can use any PC to work on my documents or train people using their equipment. Microsoft's free SyncToy keeps my documents in sync with the office and home PCs, and I have it password-protected by USB Secure. It's also handy as a backup for my files in case of hard disk failures etc.

So until fast internet access is available everywhere, I'll stick with this 'old technology'.

It's a pity SanDisk's U3 is no longer supported – it did all this as well being able to carrying OpenOffice.org and other software.

Mark Green
from the internet

With 64GB USB drives now readily available, is working from the cloud worth the effort?

GAMING GETTING TOO HARD

I've been buying and playing PC games since *Flight Simulator* on the TRS-80 back in 1981, going from hoping a tape-based program would load, to whether a handful of floppy disks would all be OK, to the magic of CDs.

Steam has shown me the next step and apart from having to be connected to the web, I like it. However, as other companies make us become web-dependent, I'm suddenly discovering that the online systems are emulating the reliability issues of the old days.

Installing *Battlefield 3* was a nightmare and it remains the only game not to run properly on my PC. What's worse, every time I go to play it, an automatic update runs, and it may spend the next day 'updating' itself, including downloading a large amount of data. Not good when you start up your PC for a 'quick' game.

Microsoft has gone one better. As a *Flight Simulator* enthusiast, I purchased its latest offering, *Microsoft Flight*. As a result, I was forced to join Microsoft Live. Just like *Battlefield 3*, the install was a nightmare, but I quite liked the simulator and purchased the add-ons. One week later, I went to log in – as you are forced to do with all these online games now – only to be told that my account had been blocked! I am so disgusted in being arbitrarily blocked that in my email to Microsoft support, I have asked for my money back, and want my Live account terminated.

All I want to do is play a game, but all of a sudden it has become so much more complicated.

James Barker
from the internet

ANDROID OVERRATED

Give me a break, Raul James (*APC* February, page 18). The headline 'Android fail' and the criticism that Android hardware and software don't work together is nothing but a loose cannon. Android has four outstanding advantages over Apple: the down/back icon, the multitasking icon, colour and configurability. These features alone leave the iPad struggling with only one button to escape. Want to change the keyboard, want to redesign your home page, want a USB or HDMI port? Then go Android!

Then with Google cloud software I can run IMAP gMail, gContacts and gCalendar on any platform wherever I am and sync them with Outlook. On top of that, any of the paid apps I want only have to be purchased once and can then be downloaded to any Android device using the same Google account.

Peter Kentley
Canterbury, Vic

EPINIONS@APCTEST.COM

Come on, have your say!

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FAKE COMMENTS

The bane of any site is people who post fake reviews to praise or damn a product. Google is backing a group of engineers to find a solution.

You've seen them. They're the reviews on a restaurant that you're really keen to try, but don't smell right and put you in two minds about whether you should book.

They are reviews like the following, adapted from a review we found about a Sydney bar (so we don't identify the business). "In love with this place, great décor and atmosphere and superb service – and the food was even better. The chicken was amazing and the crème brulee dessert was the best I've ever eaten. Will recommend it to all my friends."

It could be a real review or it could be the owner talking. When some of the reviews around it agree the venue is overpriced and the service poor, it just doesn't seem right. The review is probably bogus, the kind that's ruining the experience for users of ecommerce sites, Facebook pages and recommendation services such as Google Places, TripAdvisor, Yelp, Amazon and other such sites.

The problem is that such fake reviews are not made just by the odd individual business owner or unprincipled competitor. Increasingly, they are made by services that provide fake reviews and what's worse, they are an established part of so-called black hat internet marketing. In some cases, affiliate marketers set up entire fake reviews sites to push more users to a product they are promoting (which are easily spotted by those in the know because they contain the affiliate links).

Sadly, SEO analysis of sites with positive fake reviews show that the fake reviews work in the short term, although over the longer term, users can wisen up and the business's reputation can be damaged.

But since the culture of the internet is that reviewers don't need to verify their identity, bogus reviews (fake comments on web site, for example) are a problem to which there is no clear solution. That's why Google is backing a team of engineers at the University of Illinois in Chicago who have come up with an algorithm that detects fake reviews.

Expected to be launched shortly, it's called GSRank (Group Spam Rank) and looks for industrial-grade fake reviewing, by professionals who sell the reviews to businesses. The algorithm is most effective at detecting groups of fake reviewers because it looks for their mass production, such as a bunch suddenly appearing on a web site (apparently spammers post in four-day stretches, collect their payment and move on). Equally, professional fake reviewers don't just review one site, but several across vast geographic areas; for instance, a particular reviewer with a fake Google identity who reviews a restaurant in Google Places may review a restaurant in Sydney today, one in Perth tomorrow and in Brisbane the next day. It also looks for obvious things, such as similar language turning up in multiple posts.

If you've spotted what you think are fake comments on your favourite site, let us know and we'll run a list in the next issue. Email the examples to contact@apctest.com. apc

ENDUSER

Share the hilarity!

Do you work in the IT industry and are forced to deal with inept and clueless end users on a daily basis? Do you have an IT professional, who isn't that 'professional'? If you have an interesting or amusing story, email us at contact@apctest.com. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

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EYES ON THE PRIZE

LCD monitors are cheap these days, but which ones are up to gaming standards? Lindsay Handmer reviews eight of the latest models.

Shopping for a new gaming monitor can be a nightmare for the unprepared. Not only are there countless models available, many manufacturers tout every last model as perfect for gaming. There are also some monitors that look better suited to the office, but are actually hidden gaming gems. And 3D – don't get us started on 3D.

Chances are if you're looking to buy a gaming monitor you're at least a somewhat dedicated gamer. Even if you're not, keep in mind that many of the features in gaming-focused monitors make for excellent day-to-day use and are often some of the most affordable screens. Of course, games have fairly specific requirements.

The sweet spot for affordable, large gaming monitors is right around 23in, but more recently 27in screens have started dropping in price. While these still run the same 1,920 x 1,080 resolution, their large size gives plenty of extra real estate and means they can often double as a spare TV for video playback devices. Many gaming monitors have dual HDMI ports, too, which makes it easy to set them up with an Xbox 360 or PS3 console for total gaming flexibility.

CRITICAL SPECS

One of the main requirements for a gaming monitor is the ability to handle fast-paced action. Most important is response time (listed in ms) and low input lag. Response time is how long it takes a pixel in your LCD to change colour. When LCDs were first launched, the response times were quite low and if you had fast action on the screen, it could result in ghosting or blurring as the pixels struggled to keep up. New screens have vastly improved response times and anything under 10ms should avoid ghosting. Gamers who play a lot of fast-paced shooters often prefer monitors with response times under 2ms. The second main requirement is low input lag or the time it takes the monitor to process an image before it's displayed. Again, this is rarely an issue with modern screens.

Another spec to keep an eye on is contrast ratio. Don't get too caught up with stupidly high 'dynamic' contrast ratios; instead, look for the standard ratio. Brightness isn't much of an issue, but consider a matte screen if you game in a bright environment.

Most gaming monitors use TN panels to save money and provide fast response times. If your gaming PC doubles for other media uses, or you just want a more colour-accurate and higher-quality image, consider an IPS screen; however, expect to pay a large price premium.

EXTRA FEATURES

Don't forget to consider all the extras. USB hubs are always useful and can make plugging in a flash drive less of a chore. Premium monitors often have excellent stands, with height and rotation adjustments. Internal speakers are usually pretty rubbish, but are a useful backup.

Finally, while 3D compatibility may be the 'in' thing right now, it's worth being sceptical. The new cheaper passive 3D isn't that good, so only buy into it if you're willing to spend the time tweaking and testing to get the best result. Don't get hooked by 2D to 3D conversion as it's pretty rubbish and won't transform your gaming experience.

WHAT TO LOOK FOR ... in a gaming monitor

Speed
A monitor with a low response time will be faster, so ghosting shouldn't be an issue.

Contrast
Look for a high contrast ratio, but ignore any meaningless 'dynamic' contrast figures.

IPS
An IPS screen will offer better image quality than a TN panel.

HDMI
Look for a monitor with multiple HDMI inputs to connect it to other high-def devices.

UNDER REVIEW

ASUS VG23AH | ViewSonic VX2753mh-LED | Philips 273E3LHSB | Acer HR274H | Samsung C27A550U | LG D2342P-PN | BenQ GW2450 | Dell U2412M

ASUS VG23AH

Passive 3D paired with a high-quality panel.

@ www.asus.com.au

✔ 3D and IPS panel, HDMI 1.4 ports.

✖ Passive 3D only, ghosting, small viewing angle.

A 23in IPS monitor is a tasty enough option as is, but the ASUS VG23AH also features passive 3D. Unlike the active 3D you might be familiar with from your TV, the ASUS glasses have no batteries or electronics; instead, most of the magic happens in the monitor itself. The glasses are very lightweight and comfy, and you also get a pair that can clip onto your existing glasses.

The VG23AH can also convert a 2D source into 3D and while we found it worked OK for simple PC games, it was pretty hit and miss for video. Playing from a dedicated 3D source was much better and the monitor had no trouble recreating accurate 3D. That said, compared to active 3D technology, we ran into a few issues. The 3D only worked properly when we had the perfect viewing angle, so there's no sharing the monitor for movies. Ghosting occasionally presented in background areas, especially with light-coloured objects. Overall, quality also wasn't great and we could see minor striations in the image.

Aside from 3D, the VG23AH features a 1,920 x 1,080-pixel resolution, 5ms response time and, of course, a much sought-after IPS panel. You also get inbuilt speakers, dual HDMI 1.4 inputs as well as DVI and legacy VGA. The stand is sturdy and includes height and angle adjustment.

While we found the image quality slightly lower than an active 3D setup, at the time of writing this ASUS unit is the only 23in IPS screen with any 3D capabilities.

ViewSonic VX2753mh-LED

Is this your break into 27in gaming nirvana?

@ www.viewsonic.com.au

✔ 1ms response, dual HDMI, affordable.

✖ Small viewing angles, power brick, no bass.

As prices drop, it's more tempting to splurge on a larger monitor. This ViewSonic is thin and stylish, but still packs a 27in, LED-backlit 1,920 x 1,080 screen with all the trimmings. It features a fast 1ms grey-to-grey refresh rate (3ms typical) and a respectable 300cd/m² brightness. It has a 30,000,000:1 dynamic contrast ratio, but it's 1,200:1 typically.

We tested via HDMI and saw excellent colour reproduction and little light bleed. The matte screen reduced any reflections – even with a bright window behind us – but the viewing angles left a little to be desired. We found the dynamic brightness occasionally dimmed too much, but it's only really noticeable in some dark movie scenes. Even frantic gaming couldn't give any noticeable ghosting and there was no sign of input lag.

Round the back, the ViewSonic sports dual HDMI ports, VGA and audio I/O, although there's no DVI. It uses an external power brick to keep the monitor slim, and while that's handy because it's replaceable, it's also annoying because it adds more clutter to your desk. It also has dual 2W RMS speakers; they're OK for emergencies, but as is often the case, they seriously lack bass. During testing, the ViewSonic averaged 22W of power draw, so it certainly won't contribute much to your electricity bill.

Despite a high RRP of $569, it's readily available online for at least $200 cheaper. While it's not perfect, the VX2753mh-LED is an affordable way to get yourself a seriously large gaming monitor with decent performance.

$360

7/10

Philips 273E3LHSB

Big-screen gaming without breaking the bank.

@ www.philips.com.au

✔ Huge screen, affordable, efficient

✖ TN panel, slightly muted colour, single HDMI.

It used to be that large screens were only affordable for pretty top-notch PC builds, but thanks to steady price drops it's possible to get a little more bang for buck. The poetically named Philips 273E3LHSB sports a 27in LED-backlit screen with the typical 1,920 x 1,080 resolution. As it's aimed at the budget and gaming market, it uses a TN panel. Still, it's got a 1ms response time, 1,200:1 contrast ratio and 300cd/m² brightness.

There's a matte screen and while it keeps reflections low, even in bright environments, it means the colours don't really pop as they would with a glossy coating. If you're in a well-lit room, it's a good idea to bump the brightness up slightly to help compensate for this. There's no real backlight bleed and we didn't experience any lag or ghosting. The overall image quality was very even considering the large display and we found it gave surprisingly good viewing angles.

The Philips has a single HDMI input along with DVI and VGA. It can feed HDMI audio out to headphones or accept it in via a 3.5mm jack. The inbuilt 2W speakers are about as good as you can expect – adequate as a backup, but that's about it. There are also funky touch controls to give easy access to the OSD.

While the Philips screen might not be outstanding in any one respect, it's got decent specs and considering you can even buy it for as little as $300 if you shop around, it's a great buy.

$699

6/10

Acer HR274H

27in of 3D fun.

@ www.acer.com.au

✔ 1080p, large, fast response.

✖ Expensive, TN panel, no DVI.

3D can be a lot of fun and make gaming more immersive, but it's also expensive and needs chunky glasses that are easy to forget to charge. The HR274H makes things simpler by using passive 3D. Thankfully it's also a really good day-to-day screen, with a 1,920 x 1,080 resolution, 100,000,000:1 dynamic contrast ratio and LED backlighting. It uses a TN panel and has an excellent 2ms grey-to-grey refresh rate.

The 3D here is pretty good, though we found it somewhat finicky to find the perfect sitting position to avoid crosstalk and other weird effects. The monitor comes with two pairs of glasses, but as with the ASUS VG23AH, we struggled to get two people seeing proper 3D when both were in front of the monitor.

The Acer also does real-time conversion of 2D footage to 3D and while it can be fun to mess around with, we generally found it more miss than hit. The 3D engine chooses what should appear textured and while it tended to get simple stuff right, more complex video left it all over the place.

The HR274H has dual HDMI 1.4a inputs as well as a VGA port, but no DVI. It can handle 3D from a source such as a 3D Blu-ray player or from your Nvidia graphics card. The monitor includes speakers, which while a bit tinny are decent enough for occasional use. The Acer is brand new so you might struggle to find it for much under that highish RRP on the street.

Samsung C27A550U

The perfect upgrade for your new gaming notebook.

@ www.samsung.com/au ✔ Connectivity, 2ms response, dual HDMI. ✖ No speakers, expensive, TN panel.

Picking the right gaming monitor isn't always just about the specs. Sure, you want to know you're getting suitable hardware, but sometimes the extra features can make or break a deal. The Samsung C27A550U is 27in of 1,920 x 1,080 LED-backlit deliciousness with a 3,000:1 contrast ratio and 300cd/m² brightness. It uses a TN panel, which means the response times are nice and fast at 2ms grey-to-grey. We couldn't see any ghosting issues and the colours are as good as you'd expect from Samsung.

The C27A5550U also sports a bunch of extras that could be mistaken for an office focus, but actually really suit gaming. For a start, the base has a built-in USB 3.0 hub with four powered ports – perfect to handle your fancy light-up keyboards and gaming mice without filling up limited PC connections. It has dual HDMI ports (as well as legacy VGA) so you can connect a PC and console at the same time. The monitor base station also includes a LAN port that can then feed internet connectivity to your PC via USB.

All these features conspire to make the Samsung pretty much the ultimate screen for use with a high-end gaming notebook. You can leave your mouse and keyboard connected to the screen and then hook up your notebook with just two cables.

At almost $500 on the street, the Samsung is an expensive option, but is packed with all the features notebook gamers crave.

LG D2342P-PN

Can LG compete in the passive 3D market?

@ www.lg.com/au ✔ Cheapish, 3D, light glasses. ✖ Ghosting, light bleed, poor viewing angles.

If your budget can't extend to a 27in monitor, 3D or otherwise, the LG D2342P-PN monitor is a 3D, 23in alternative. It has a 1,920 x 1,080 resolution LED-backlit screen with a 5,000,000:1 dynamic contrast ratio and 250cd/m² brightness rating. The TN panel has a slightly slower 5ms response time, but in normal testing we didn't notice any ghosting issues. Out of the box the colours were a little dull, but some tweaking in the OSD brightened things up without it looking too fake. The LG has minor light bleed along the bottom edge of the screen, but not enough to worry about for normal everyday use.

The LG comes with a pair of awesomely comfy, somewhat hipster yet ultimately quite flimsy passive 3D glasses, plus a pair of clip-ons in case you already wear glasses. While the monitor handles 3D content from a dedicated source OK, we experienced quite a bit of crosstalk and 3D ghosting. A very precise seating position and limited movements can minimise this, although really it's a bit of a chore. The 2D to 3D conversion mode is acceptable for messing about with, but you wouldn't want to use it to watch an entire movie.

The LG has HDMI and DVI ports, plus an old-school VGA connector. Handily, it also has a 3.5mm audio output jack to feed sound from the HDMI input to your headphones. At around $300 online, it's not a cheap 23in monitor, so unless you really want to try your hand at 3D gaming, there are better options.

BenQ GW2450

Should your next monitor feature a VA panel?

@ www.benq.com.au

✔ VA panel, deep blacks, good viewing angles.

✖ Weak speakers, slightly washed-out colours, no street price.

BenQ was one of the first companies to introduce an LED-backlit VA (vertical alignment) panel last year and now has a second-generation model. The GW2450 has a 24in screen and runs a standard 1,920 x 1,080 resolution. It has a 250cd/m² brightness and a very high 5,000:1 contrast ratio.

By default the BenQ is very bright, which we found washed out the colours slightly. With a suitably lit room and a little tweaking, colour reproduction is vibrant without being overwhelming. At 178° vertically and horizontally, the viewing angles are likewise pretty good, and the matte screen reduces reflections from any direction. Backlight bleed is virtually non-existent and blacks were very deep. The 4ms grey-to-grey response time is higher than some monitors, but we didn't have an issue with ghosting or any input lag.

The BenQ sports a single HDMI port as well as VGA and DVI connections. As expected, the internal speakers lack bass, but are usable in a pinch. You also get a headphone jack for audio output from an HDMI source.

While it's more expensive than similar-sized TN panel monitors, the GW2450 is targeted at those who want a little better image quality. The VA panel image is very sharp and has excellent blacks; if you like to play a lot of dark games, you'll really notice the difference between this and a regular TN panel.

The BenQ GW2450 is so new that there aren't any street prices yet, but nevertheless, it's a good deal at only $199.

Dell U2412M

The extra quality you crave.

@ www.dell.com.au

✔ IPS panel, excellent colour, DisplayPort.

✖ No HDMI, high response time, 6-bit.

While gamers tend to favour monitors with fast refresh rates, there are many other screens with better-quality images that are still suitable for gaming. The Dell U2412M is popular among gamers and non-gamers alike, as it uses a high-quality 24in LED-backlit IPS panel. It also features a full 1,920 x 1,200 resolution for a 16:10 aspect ratio, rather than the more common 16:9. While it's not a true 8-bit panel, the Dell uses 6 bits plus advanced frame control to make up the difference. Round the back, the U2412M has DisplayPort, DVI and VGA; however, there's no HDMI. You do get a four-port USB hub, though.

The downfall of many IPS panels is slow response times and ghosting. The Dell has a higher-than-average 8ms response time, which might put some gamers off. Despite our best efforts, we couldn't get any ghosting in actual gaming, though. The extra dollars you'll need to cough up for an IPS panel buys you excellent picture quality and rich and vibrant colours without going over the top. We found it very bright by default, so unless you're gaming outside, dimming it to your environment is a good idea. There's no appreciable light leakage, even in the darkest games, and screen uniformity is excellent. The OSD is also excellent and gives comprehensive access to any and all the settings you'll need.

As we've come to expect from Dell, the stand is a cut above the norm with full height and rotation adjustments. This one's also frequently on sale, so you can often pick it up for under $300. apc

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CLICK MASTERS

Lindsay Handmer gets his hands all over the latest gaming mice.

You could be forgiven for thinking that mouse technology hasn't advanced much since the first optical sensors, but behind the scenes there's actually been a veritable arms race of specs. The gaming mouse market is a hotly contested one and tech-wise they're all about precision; in fact, there are entire companies dedicated to building the perfect super sensor. High dpi counts are a bit like five-bladed shavers, though: the idea looks great on paper and works fine, but in reality it's total overkill. Aside from ever-increasing tracking sensitivity and accuracy, modern gaming mice have actually gotten extremely sophisticated. It used to be that a bit of stray dust could send your pointer whizzing about, whereas now most mice work equally well on a pad, desk or even your cat.

NEW KIDS

The very latest additions to gaming mice are about getting the most from your buttons for intensive new games. This is often done via software where you can customise endless settings. Many mice even let you program how high off your mouse pad you can lift them before they stop tracking the surface. Having a known brand that will constantly improve and update its mouse software can be a big win, as updates can lend new life to an older mouse.

You might also expect to see more wireless gaming mice, but the technology has largely been shunned by gamers. In our testing there's little to no appreciable lag when using a wireless mouse, but many gamers remain unconvinced. If you crave a wireless gaming mouse, there are a few models available, although the market is still largely dominated by wired versions.

LET THE MOUSE PICK YOU

Shopping for a new mouse can be a bit of an ordeal, with countless acronyms and specs that often mean nothing to the average user. Most gaming mice use optical sensors while some use laser setups, and a rare few combine both. Both technologies offer excellent accuracy; however, optical mice are better suited to use on mouse pads and can have issues with shiny surfaces, while laser mice generally handle a variety of surfaces well.

The resolution of the sensor is measured in dpi and higher numbers mean smoother tracking. For most people, anything over a few thousand dots per inch will be more than adequate. Adjustable dpi lets you vary how far the cursor moves compared to how far you're moving the actual mouse.

The ips (inches per second) rating is the speed at which the mouse can move and still track the surface. This is often also reported in metric as metres per second. This matters because some FPS players like to turn the dpi down very low and use very large mouse movements to improve accuracy.

It's also very important to consider the physical size and weight of the mouse – larger hands on a smaller mouse result in the 'claw' hand grip, where the palm is clear of the mouse and the fingers do the work. A larger mouse or smaller hand lets your palm rest on the back of the mouse. Most mice are right-handed in design so if you're a leftie, make sure the shape is ambidextrous.

Almost all mice have programmable buttons, but the best store the profiles on the mouse; in the latter case, if you use your mouse on a new computer, the buttons still work as originally programmed.

WHAT TO LOOK FOR ...

... in gaming mice

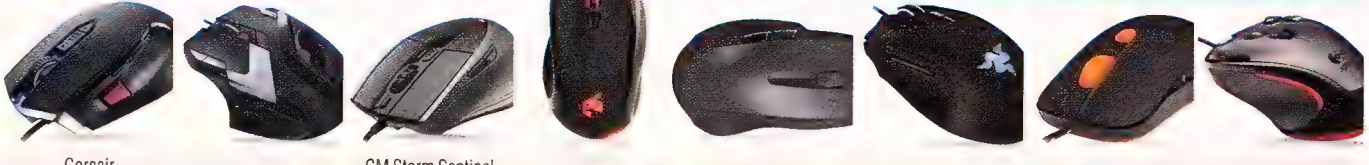
Size
Contrary to the popular adage, size does matter. Try before you buy to avoid 'claw hand'.

Resolution
The higher the dpi, the better — it means smoother tracking. Anything over a few thousand will do.

Updates
Choose a brand that regularly updates its configuration software.

Weight
Some come with removable weights for adjustment.

UNDER REVIEW



Corsair Vengeance M60 | Genius DeathTaker | CM Storm Sentinel Advance II | Epic Gear Meduza | Roccat Savu | Razer Imperator 4G | SteelSeries Kana | Logitech G300

- SNIPER BUTTON
- OPEN DESIGN
- MATCHING KEYBOARD

$69

9/10

APC MAGAZINE apc EDITOR'S CHOICE

Corsair Vengeance M60

What a gaming mouse should be.

@ www.corsair.com

✔ Unique design, slippery feet, adjustable weights.

✖ Slightly small, weird style for some, theft target.

It's quite rare for a truly different gaming mouse to come along and even more so for it to satisfy picky gamers. The Corsair Vengeance M60 stands out, thanks to a chunky folded aluminium core, with the panels attached to the outside. This gives it a unique feel and a great open-air look. It redefines the criteria for a gaming mouse.

Inside the M60 is a 5,700dpi Avago ADNS-9500 LaserStream sensor that can be adjusted in 100dpi increments. It can handle 30G acceleration and a tracking speed of up to 165ips.

In testing, we held the M60 in a half-claw grip, but those with smaller hands will easily be able to rest their palms. It's very comfortable in use and the large air gaps help keep your hand cool in the heat of battle. The feet are extremely slippery and it includes three removable weights. The scroll wheel is also very solid and has an excellent feel, as well as blue backlighting.

The M60 also has a unique Sniper button. Activated with your thumb, this drops the dpi slightly while pressed to allow for more accurate aiming if sniping. It also has two more thumb buttons that, along with all the other buttons, can be programmed to whatever action or macro you'd like.

If you want to co-ordinate your peripherals, the M60 design is also carried across to the excellent Corsair K90 keyboard. Perhaps the M60's best aspect is that it can be bought for under $70 online; we'd consider it a great addition to almost any gaming setup.

- INSTANT PROFILE BUTTON
- REMOVABLE WEIGHTS
- MMORPG & RTS SUITED

$59

7/10

Genius DeathTaker

Packed with a million and one features, including profile setting. Scythe not included.

@ www.geniusnet.com

✔ Cheap, 5,700dpi, profiles.

✖ Plasticky, light, small.

If you ignore the name for a minute, the DeathTaker shows solid potential, especially considering you can find it online for under $60. Like many mice these days, it has a laser sensor, a million and one buttons and the ability to set profiles.

In our rather large hands, the Genius mouse feels a little small and not unlike certain Logitech offerings. It's also quite light, though it has six 5.4g weights you can slot in to make it heavier if desired. Thanks to the 5,700dpi sensor, we found the DeathTaker very smooth and precise across a range of surfaces, including a bare desk. The braided cable is rather firm and we had to work it a little before we were happy with its flexibility.

Genius pushes this as an MMORPG and RTS mouse due to the fairly comprehensive macro abilities. You can set custom actions to all the buttons (except left-click) and create five different profiles for different games. You can also toggle between profiles while playing. But our favourite option is the instant profile button, which works like a function key for your profiles, essentially giving each button a second easily accessible action.

The DeathTaker also has controllable LEDs you can set to match your computer colour scheme, though sadly this does little to improve its plasticky look. The included profile and setup software is quite comprehensive, but it's sometimes a little clunky. If you play a lot of RTS games or MMOs, this mouse has a solid feature set on a budget.

CM Storm Sentinel Advance II

An upgrade to a recent classic.

@ www.cmstorm.com ✔ Accurate, large, solid. ✖ Reused body, top grill, complex.

We loved the original CM Storm Sentinel Advance, so it's excellent news for gamers that Cooler Master has released an updated version. The well-known styling remains as is, but the guts of the new version have had a total makeover.

The Sentinel is built around the brand-new Avago ADNS-9800 laser sensor used in many top gaming mice. It has a dpi adjustable between 200 and 8,200, with a 3.8ms (150ips) tracking speed and 30G acceleration. In the real world this means it tracked extremely well, no matter how frantic we got. It also has a 1.5mm lift-off distance and it was very easy to reposition the mouse without jitter or movement. The Sentinel also has a 1,000Hz USB polling rate, so you won't get any lag at that end.

The Cooler Master is a long palm rest-style mouse and will suit those with larger hands. Like the old model, it can tend to collect gunk from your hand on the top grille, which can be a pain to clean. At 139g it feels solid without being slow to move around, though you can adjust the weight.

The braided cord is nice and flexible, and the large feet help the Sentinel slide smoothly over a variety of surfaces. It also has the usual array of eight programmable buttons, profiles that are stored in the mouse and a customisable multicolour LED on top and underneath. The mouse also has a built-in OLED that can show dpi or even your own custom logo.

Epic Gear Meduza

A new brand with a controversial but feature-packed new mouse you'll either love or hate.

@ www.epicgear.com ✔ Dual sensor, LED backlit, new shape. ✖ Pricey, unknown brand, new shape.

While you may never have heard of Epic Gear, the company has a solid background, falling under the GEIL brand whose RAM is in countless gaming PCs. Still, that doesn't mean it can necessarily build a decent mouse.

The Meduza is one of those mice that seems to create love or hate first impressions (Sidewinder X3 anyone?) and in our office we had a pretty even spread. No mouse will suit everyone, but the shape of the Meduza feels downright weird compared to other mice. Your palm sits atop the mouse, but there's an extra ridge for your ring finger only, which leaves your pinky dangling. At first you feel like you're just batting the mouse around with your palm, but with extended play that overall shape does feel like it could reduce fatigue from squeezing.

Still, no-one can argue with the hardware, as the Meduza features both optical and laser sensors to get the most accurate tracking on any surface. You can set it to use either sensor for specific surfaces. It has an adjustable sensitivity of up to 6,000dpi, can handle 30G acceleration and has a tracking speed of 5ms (200ips).

It has six programmable buttons as well as five different profiles for your favourite games, which correspond with different LED backlight colours. You can also change the horizontal and vertical axis dpi separately, and of course, store all your changes and profiles in the mouse itself. The included software makes it easy to program and adjust all your settings.

- SHIFT KEY BUTTON SETUP
- NO INTERPOLATION SENSOR
- RECORDED MOUSE SKILLS STATS

$69

8/10

APC MAGAZINE HIGHLY RECOMMENDED

Roccat Savu

Precision German engineering that offers the world's first 4,000dpi optical sensor.

@ www.roccat.org

✔ Optical sensor, slippery feet, great software.

✖ Hard to find, light, lower specs.

The Savu makes an excellent first impression, thanks to a tough yet understated style that's backed up by an extremely solid feel and a comfortable fit. It's worth noting that while we held the medium-size Savu in a claw-like manner, those with smaller hands could use it as a palm mouse. The textured side panels are very grippy, even when things get sweaty.

The specs on the Savu really stand out, too, with what's claimed as the world's only 4,000dpi optical sensor for very precise optical control – no interpolation needed. It also has a 1.5ms (60ips) tracking speed and can handle 20G acceleration. This might seem like less than many other mice, but the Savu is all about getting precision tracking from an optical sensor, not joining the mouse specs arms race. The Savu also has the slipperiest feet we've ever used, making it easy to maintain very precise movements even when gaming for extended periods. At 90g it's a very light mouse, so if you prefer some heft, you'd best look elsewhere.

Rather than an overkill array of programmable buttons, the Savu uses one button as a Shift key, letting you assign two functions to each button. This reduces clutter on the mouse and leaves fewer places your fingers need to stretch to during those intense *Starcraft* battles. The included software lets you set up your buttons, control the backlight colour and even record statistics such as movements and click counts, so you can review your mouse skills later.

- EXCELLENT SOFTWARE
- ADJUSTABLE SIDE BUTTONS
- BRAIDED CORD

$95

8/10

APC MAGAZINE HIGHLY RECOMMENDED

Razer Imperator 4G

A mouse packed to the gills with technology: custom actions, profiles, precision tracking and more.

@ au.razerzone.com

✔ Dual sensor, nice feel, high dpi.

✖ Right-handed, no extra weights, pricey.

For day-to-day use, you might not care too much about dpi, G-force handling or polling rates. But if you're a hardcore gamer, any little edge you can get over your opponents is worth it. The Razer goes all out to maximise your gaming skills, with a 6,400dpi 4G sensor. You might be wondering what the Imperator is doing with mobile phone technology, but really the 4G sensor here means it's equipped with a dual optical and laser setup for precision tracking on any surface.

In use, the Imperator is very comfortable, though it's set up for right-handers only. You can adjust the side buttons forward and back, but even with our large hands we wished the buttons could be moved further back. The Imperator doesn't come with adjustable weights and we found it a touch too lightweight for us; however, that's a matter of personal opinion. The surface is coated in soft-touch plastic, giving a solid grip even with hot or oily hands. Like any good gaming mouse, the dpi is totally adjustable – you can set custom actions to the buttons and set up multiple gaming profiles.

The included software is excellent and gives control over just about everything you could want, including customising the mouse to your desktop surface and setting the lift-off cut-out height.

For the hardcore gamer, the Razer has every last feature you could need, though be prepared to spend almost $100 for the pleasure of owning it yourself.

AMBIDEXTROUS

AVAILABLE IN BLACK OR WHITE

REPLACEABLE FEET

$59

6/10

SteelSeries Kana

Built for the everyman gamer, with a raft of top-notch tech.

@ www.steelseries.com

✔ Simple, programmable, small.

✖ Light, plasticky, few buttons.

While many vendors are going nuts with exotic feature-packed mice, SteelSeries has reined things in a little with the Kana. We would like to call it average, but that wouldn't do justice to the top-notch tech inside. Still, it costs under $60, is middle of the road in terms of size and doesn't have a bewildering array of buttons.

SteelSeries actually got gamers to vote for different features of the mouse, but we're not quite convinced that means it's 'designed by gamers' as it claims. The Kana weighs in at a slim 72g and to be honest, it feels a bit plasticky. Unless you have tiny hands, you'll be holding the Kana in a claw grip, though it's not uncomfortable. It's also suited for both lefties and righties, which few gaming mice are. Inside it has an adjustable 3,200dpi optical sensor, with a tracking rate of 130ips, 2mm lift-off and it can handle 30G acceleration. Thanks to the extra-large (and replaceable) feet, it's smooth to operate, but it feels somewhat gritty on our bare desk. It also has a nice braided cord with plenty of flex.

The Kana keeps it simple with one button per side, so with the normal set, this gives a total of six programmable buttons. The included software lets you record macros, set up profiles and even track button-pressing stats. It's also LED-backlit with adjustable colours that can match your settings.

The Kana comes in black or white and if you're after a simple yet effective mouse, it's worth checking out.

AMBIDEXTROUS

2,500dpi SENSOR

ONBOARD PROFILE MEMORY

$45

7/10

Logitech G300

Combines the known quality of Logitech with a budget price.

@ www.logitech.com

✔ Affordable, accurate, LED lighting.

✖ Plasticky, Spartan software, three-key macro.

Before we even get our hands on new Logitech gear, we just know it's going to be good. Perhaps the company did a deal with the devil, or perhaps it just has really good engineers. Whatever the case, the G300 promises to bring top-notch Logitech quality to budget gamers. This little beastie can be rustled up from your favourite online retailers for as little as $45.

We'll admit that the G300 feels a little light and flimsy at first, particularly if you're used to a heavy mouse, but it's still well built and very nimble. Even better, it's designed for right- or left-handed use and is comfortable either way. The G300 has a 2,500dpi sensor and in testing we found it tracked perfectly, no matter how energetic we got. We held the G300 in the claw fashion, but those with smaller hands shouldn't have an issue resting their palm on its curved back. The matte surface has decent grip, but is smooth enough not to attract too much dirt.

The design also has a touch of bling, thanks to the customisable seven-colour glowing highlighting along the sides. You can program different actions to the nine extra buttons, but sadly, it can only store very short three-key macros. You can set three different profiles and the mouse has onboard memory to store them.

The included configuration software is also pretty Spartan, but it does let you set up your programmable keys and it's actually pretty workable for the average user.

THE KEY ADVANTAGE

LED backlighting, purpose-built switches and ultra-sensitive controls are just a few of the ways gaming keyboards are making their cutting-edge mark. Lindsay Handmer investigates.

Today's keyboards are modern marvels of science compared to the crusty old PS/2 monstrosities of yesteryear. A few purists may argue that current keyboards never managed to better the feel of the clacking beige bricks from the '90s, but they're oh so wrong.

Still, it's hard to ignore that mechanical keyboards are making a comeback, with most using Cherry MX switches that have been purpose-built for gaming. These come in a range of flavours that give different sensitivity and feel, which ranges from extra tactile to super-firm for aggressive gamers. But while mechanical keys can offer excellent feel and responsiveness, they're louder, taller and for some, just too old school.

Switches aren't the keyboard hardware getting a makeover, however; many new releases also include funky LED backlighting for ease of use in dark rooms, media controls and little extras such as USB hubs. Extra hardware such as USB sound cards, LCDs and even fans are sneaking their way in, but really all the gadgets in the world can't substitute for a solid, comfortable feel.

As with mice, you'll struggle to find many wireless gaming keyboards due to lag issues – both real and unjustly perceived. In our testing we haven't had any issues with wireless tech, but gamers who demand the most responsive gameplay shy away from potential slowdowns. If wireless is more your style, then you'll find that many manufacturers offer a wireless version of existing keyboards.

DIFFERENT STROKES

Shopping for a new keyboard can seem deceptively simple, but it's worth locking down a few basics before you drain the bank account. Mechanical keyboards might be all the rage, but it's worth finding a shop where you can play with one in person before committing.

All current gaming keyboards have at least five programmable gaming keys, but more isn't always better – in most games you only use a small selection of keys. Decent control software lets you bind unused normal keys to new functions and macros, and set profiles for specific games. If you play a lot of RTS games or MMOs, then going all out on a keyboard packed with gaming keys can be worthwhile.

Don't discount last year's models either, as they often have almost all the features of newer versions at a fraction of the cost. We've included two very popular older keyboards from Gigabyte and Thermaltake that offer decent budget buys.

It can be tempting to fall for the first super-cheap and pretty no-name keyboard you spot at your local computer store, but it really is worth going for a known brand. Generic keyboards often don't have features that are taken for granted on better models, such as being able to press a bunch of keys at once without signals getting lost.

Consider your primary purpose before buying a keyboard, as they're often targeted towards certain games. If you also do a lot of typing, a more general-purpose keyboard might be in order.

WHAT TO LOOK FOR ... in a gaming board

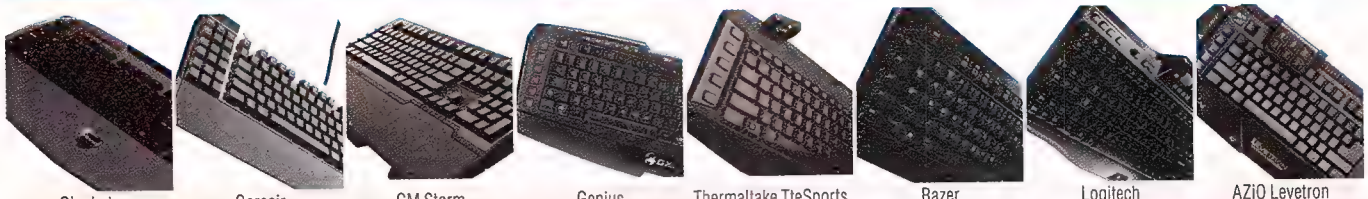
USB hub
Having USB ports here frees up your PC's ports for other peripherals.

Macro keys
Macro keys make it easy to customise your keyboard shortcuts for different games.

Profiles
Switchable profiles offer a quick way to set up your keyboard for different games.

Controls
Audio and media controls mean there's no digging in menus to make adjustments during a game.

UNDER REVIEW



Gigabyte Aivia K8100 | Corsair Vengeance K90 | CM Storm Trigger | Genius Imperator | Thermaltake TteSports Challenger Pro | Razer BlackWidow | Logitech G510 | AZiO Levetron Mech4

$75

7/10

Gigabyte Aivia K8100

Like a party all over your desk.

@ www.gigabyte.com.au
✔ Cheap, slim, colourful
✖ Awkward gaming keys, clunky if not gaming, last year's model

The Aivia K8100 gaming keyboard is designed not only to be functional, but also stand out from the normal array of options, with bright yellow and red models as well as the standard black.

The K8100 has been kicking about now for a year and a half, yet remains a very popular and widely available keyboard, thanks to its gamer-centric features. Rather than down the side, the K8100 places the programmable gaming keys in a row above the function keys. While they're easy enough to reach, this placement is a little clunkier than side keys, though they're OK if you have very large hands. On the plus side, this makes the K8100 a little easier to fit on small desks or to use at a cramped LAN party. You also get a touch-sensitive mute and volume control area, and an LED-backlit volume indicator.

The keys aren't mechanical, but the normal gaming WASD keys are firmer than the others, giving an excellent feel. The whole lot are also LED-backlit with hardware on/off switches.

If you like to pound out novels in your spare time, the different force needed for different keys could potentially get annoying, but the large wrist rest and thin design make it very comfortable for long gaming sessions. The included software makes it easy to program your own macros and assign up to 100 profiles that can be toggled with the profile changer key.

The K8100 is an excellent buy for under $80 on the street and brings style and features to your gaming setup.

$160

7/10

Corsair Vengeance K90

Seemingly carved from a chunk of solid aluminium.

@ www.corsair.com
✔ Cherry MX Red keys, stylish build, exposed keys.
✖ Expensive, odd key feel, gaming keys not mechanical.

Like many tech companies these days, Corsair is expanding its lineup and moving into gaming accessories. The Vengeance K90 is the company's first gaming keyboard, so it's no surprise that its designers have gone all out. The K90 is built around a strip of carefully shaped brushed aluminium and has a rather minimalistic look. It uses Cherry MX Red mechanical switches for a superior feel. It's also backlit, with adjustable blue brightness LEDs under every key. For the MMO or RTS crowd, the K90 has 18 programmable gaming keys and three different profiles, though these aren't mechanical. You also get a Windows key lockout button, dedicated media controls and a nice, solid volume wheel.

The K90 takes a bit of getting used to, as the keys feel different to other keyboards. The surfaces are a little concave, the key tops small and the spacing between them quite large. This feels a little weird at first, but once you acclimatise, it's fast and accurate. The keys are also very exposed so they won't trap any dirt.

The included software is needed to set up custom key actions or macros, but once programmed they can be stored in the onboard memory. The K90 also has a quality screw-on wrist rest and single USB port for your mouse or flash drive.

While it's an excellent keyboard, you'll struggle to buy the K90 for under $160. If you have more of an FPS focus, consider checking out the Vengeance K60, which can be found a little cheaper.

CM Storm Trigger

A surprisingly affordable mechanical keyboard.

@ www.cmstorm.com ✔ Backlit keys, five macro keys, media keys. ✖ Price close to RRP, complex, noisy.

Cooler Master has been making serious inroads into the gaming peripherals market lately, with solid and reasonably priced products. The new Trigger keyboard sticks to the trend and offers a lot of bang for a large yet still reasonable amount of buck.

The Trigger is a mechanical board with firm and smooth keys, which give a very satisfying but somewhat noisy clunk to every press. While more expensive to produce, mechanical keyboards are loved for their excellent response and feel. The Trigger uses Cherry MX switches and you can choose from three different versions that use different switches inside. We tested the Blue switches for an increased tactile feel.

The Trigger isn't a one-trick pony, though – it has a lot to offer elsewhere. For gaming in a dark room, the fully backlit keys are great (you can also turn them off). The keyboard has five customisable macro keys with profile setups that are stored in the keyboard. You can also lock out the Windows key when gaming. A removable wrist rest, media keys, braided USB cable and two-port USB hub round out the feature set. The included software makes changing settings or setting up gaming profiles super easy, though oddly, we needed it installed to run the backlights.

The Trigger is fairly new, so you'll need to shop around to find it for much under the RRP. Still, if you're after a very solid and affordable mechanical keyboard, it's worth a look.

Genius Imperator

Aimed at gamers on a budget.

@ www.geniusnet.com ✔ Budget, six macro keys, media keys. ✖ Plasticky, lightweight, no backlight.

Not everyone can afford to spend $100+ on a fancypants gaming keyboard, so it's nice to see you can buy the Imperator online for under $50. For the price, you get most of the gaming features you know and love, but keep in mind this is still a relatively budget option.

The Imperator is very comfortable to use and while it's a little plasticky at times, it gets the job done. It has six programmable macro keys on the left-hand side, which can be set with the included software. You also have three different profile keys, letting you easily set up different configurations for your favourite games. There's also a gaming mode, which disables the Windows key to avoid any mid-game mishaps. The Imperator also has separate media keys for volume and video playback control.

It uses a 1,000Hz polling rate and has inbuilt memory to ensure that no matter how rapidly you mash buttons, the keystrokes are never lost and will make it through to your game.

The Imperator doesn't have any backlighting, but it does have a nice, solid braided cord and integrated wrist rest. The board's light weight does give it a tendency to slide around on the desk a little, especially if you're really getting into a game. Putting the feet up helps, but sitting the keyboard on something grippier than a desktop is a good idea.

If you want to shell out some extra cash, you can get the Pro version with LED backlighting and a USB hub.

Thermaltake Tt eSports Challenger Pro

The only keyboard with an inbuilt fan.

@ www.thermaltake.com.au

✔ Affordable, programmable keys, USB hub

✖ Flexible, not mechanical, aging model

As a supporter of the World Cyber Games, Thermaltake has released a range of professionally backed gaming gear. Despite having not been updated as recently as its competitors, the Challenger Pro keyboard has a lot to offer and has visual appeal, with a red and black theme, a glowing Tt logo and LED backlighting.

The Challenger Pro doesn't use mechanical keys, instead featuring rather flat, almost notebook-like buttons. The whole keyboard itself is rather thin and minimalistic, though still very comfortable to use. If you really bash at it, you can get a little flex, but otherwise it's suitably solid.

The keyboard includes five programmable gaming keys down the left-hand side, which can handle custom actions and macros, and store these and your profiles onboard. The WASD keys are designed to be removed and can be replaced with the included bright red gaming versions.

Tucked into the back of the Challenger Pro is a little fan that directs a cool breeze over your fingers when it's plugged in at the top. It seems gimmicky, but in a heated gaming session, it's actually rather useful. The cord is removable as well as braided and the keyboard includes two extra USB ports.

If you shop around there's no reason to pay more than $80 for the Challenger Pro. If you want to save some cash and don't mind missing out on backlit keys, you can grab the regular non-Pro version for up to $30 less.

Razer BlackWidow

Available in a range of specs.

@ au.razerzone.com

✔ Mechanical keys, solid, programmable keys.

✖ Loud, pricey, base model.

In the neverending battle between gamers and their finances, fancy bits of kit like mechanical keyboards often get sidelined. The Razer BlackWidow deserves a second look, though, as the base version we tested has good features considering the price.

If you haven't used a mechanical keyboard before, be warned that it can be a bit of an acquired taste. For a start it's noisy, with each key press clacking like that giant, old keyboard from your first PC. Still, the key presses are very smooth and easy, needing only a 2mm press and 50g of weight to activate. While it takes some getting used to, the biggest eye-opener for us was when, after a solid night of *Star Wars: The Old Republic*, we plugged our old keyboard back in. It was a sloppy, inaccurate mess to use in comparison and we were totally sold.

The BlackWidow also has the usual gaming fare, including five programmable keys that can handle functions or macros on the fly and up to 10 different profiles. You also get media controls, along with a braided cord and the expected gaming mode to disable the Windows key. The BlackWidow is a hefty keyboard that's not really suited to lightweight LAN partiers, although it feels super-solid on your desk.

If you want to go all out, there's also an Ultimate (but expensive) version of the BlackWidow with custom backlighting, a USB hub and inbuilt audio ports. As always, shop around to ensure you get the model you want at a price you can afford.

$100

9/10

Logitech G510

Designed for hardcore gamers.

@ www.logitech.com ✔ Backlit, 18 G keys, high quality. ✖ Large, possibly overkill.

The G range of Logitech products is extremely popular with gamers, despite the sometimes hefty price tags. The G510 gaming keyboard is no exception and offers absolute top-notch features; however, amazingly, it does so for a surprisingly affordable price.

The G510 includes the signature Logitech LCD, which can provide gaming stats, system telemetry or any other information you want via third-party software. You also get a full 18 individual programmable G keys that can be assigned actions or macros of your choosing, as well as three profiles. This is a huge boon to hardcore RTS or MMO players who crave easy access to many functions. You also get a Windows key lockout mode for gaming.

The G510 has backlit keys with adjustable colours and intensity, along with media control buttons and an excellent volume wheel. In a move we love, it even has a USB sound card in the keyboard so you can simply plug your headphones straight in. No USB hub is included, though, which is a bit disappointing. The G510 is extremely comfortable to use and key presses are solid yet smooth. It sits very securely on your desk and won't move around accidentally; those who are cramped for space should be aware that the G510 is a very wide keyboard at 51cm.

For those who don't play MMOs, the 18 G keys might seem like overkill, but remember that you can also assign them to your favourite Windows functions. Even so, the rest of the G510's features make it a solid choice.

$145

7/10

AZiO Levetron Mech4

A mechanical keyboard with a difference.

@ www.aziocorp.com ✔ Splashproof, modular, excellent feet. ✖ Large, pricey, low-power USB port.

When it comes to high-end gaming keyboards, it's hard to stand out from the crowd. Logitech does it with LCDs, but AZiO has taken it to a new level with the Levetron Mech4. It doesn't levitate and it doesn't turn into a mech, but it's totally modular for maximum customisation. It's also somewhat waterproof and while you can't whip it out in the shower, it will direct wayward Mountain Dew harmlessly out the bottom... then presumably across your desk and into your $2,000 gaming rig.

The Mech4 uses Cherry MX Black switches rated to 50 million strikes for a smooth yet solid feel. The keypad can attach to either side of the keyboard or be removed entirely. While the Mech4 includes six programmable gaming keys on the main keyboard, there's also a separate pad with an additional six buttons. This can be clipped to the top of the keyboard or placed elsewhere on your desk.

Using the included software, almost all the keys on the Mech4 are programmable and you can save as many different profiles as you desire. The stands on the Mech4 offer three different levels of height adjustment and all include rubber grips to avoid movement on your desk.

The Mech4 also has a Windows key disable button, a large volume knob and a calculator launch hotkey on the keypad. You also get two extra USB ports, though they'll only handle low-power devices. For a touch of bling, the left-hand side programmable keys and volume control are backlit blue. APC

WEIRD & WONDERFUL GAMING GADGETS

Lindsay Handmer takes a look at some unusual and wacky tech gear that's designed to make your gaming better.

Every gamer has a favourite mouse and keyboard, but it's rare to see anything much out of the ordinary when it comes to gaming accessories. Sure, the occasional force feedback wheel or flight yoke can be spotted in the wild. But come on, it's 2012 – we were hoping for VR goggles and full-body gaming suits by now!

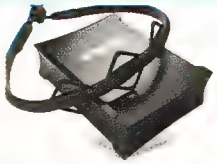
Sadly, though, the mouse and keyboard combo (and perhaps console controller) is just too good compared to most hopeful newcomers. Professional gamers will happily adopt any new technology that could give them an edge in gaming, but so far there isn't a lot of action. Despite this there are still a few weird, wacky and fun peripherals you can buy right now. Some of them are even actually useful when gaming.

When shopping for unconventional accessories it's always worth looking at the second-hand market. Many gamers buy the latest gadget, but barely use it before giving up. These can often be found for sale through forums or eBay at a fraction of the cost of a new one.

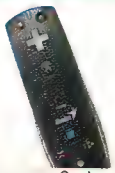
It's also worth noting the Peregrine gaming glove. It's not available in Australia (though you can buy it on Amazon) so we don't yet have one for review, but it lets you control your games with touch points and activator pads for totally hands-on gaming. If you want to finally be able to update your old Nintendo power glove for use with your PC, then it's potentially worth a look.

UNDER REVIEW

Logitech G13


OCZ Neural Impulse Actuator

D-Box GP-200


Genius Wizard Stick

Razer Mouse Bungee

25 PROGRAMMABLE KEYS

LCD GAME PANEL

BACKLIT

Logitech G13

A gameboard with a difference.

@ www.logitech.com

✔ Quality build, comfortable, sweet mini joystick.

✖ Pricey, limited use, getting on in age.

When it comes to funky PC gaming peripherals, you can't go past the Logitech G13. Sure, it's been kicking about for a few years now, but it still has no equal. It's solid, feature-packed and backed by one of the best names in the business.

When gaming, most of your keyboard is a big waste of space, so Logitech cut out the fluff and put only the features you need into the G13. It has 25 programmable keys that can handle any function as well as macros, plus five profiles for different games. It also has a mini joystick operated by your thumb, which can be used directly for gaming or also assigned custom actions.

As is the Logitech way, it also has a small LCD game panel that can display game state or system information such as temperatures. For those who like to tinker, there are quite a few programs available to allow you to display all sorts of different information on the screen. It's also backlit for ease of use at night.

In use, the G13 is remarkably comfortable, thanks to the large palm-rest. It's also rather solid, so no matter how rough you get, the G13 stays put on your desk.

The Logitech G13 still carries a fairly hefty price premium, so make sure you really compare prices online. Quite a few places are still trying to flog the G13 for the original launch price, but shop around as you can grab one new for less than $100. You can also often find almost unused models second-hand.

- THREE NEURAL SENSORS
- EYEBROW MOVEMENT DETECTION
- PRACTISE GAMES INCLUDED

$130

6/10

OCZ Neural Impulse Actuator

Mind control your PC.

@ www.ocztechnology.com

✔ Mind control, unique, fun.

✖ Hard to learn, inaccurate, needs calibration.

As gaming accessories go, it doesn't get much more out there than the OCZ Neural Impulse Actuator (or NIA). Clearly bored with cumbersome mice and keyboard interfaces, OCZ built a system that lets you control your PC with your brainwaves. The NIA was launched way back in 2008, although you can still buy it from a few online retailers or pick one up second-hand.

We were fortunate enough to be able to track one down and put it through its paces. The NIA consists of a control box, software and, of course, the actual neural headset sensor itself. The rubber headband is fairly comfortable to wear and includes three neural sensors as well as muscle sensors that can detect the raising of your eyebrows.

The software includes a comprehensive tutorial that covers everything from putting on the headset correctly to calibrations. You also get a bunch of practise modes like Pong to hone your control.

We found that some users could easily get a response from the device, whereas others had so much neural 'noise' that calibration itself was almost impossible. In actual games, the NIA was a fun way to drive a car with our minds, but it certainly didn't improve our skill levels.

It's important to remember that the NIA is not an instant gaming solution. It's like learning a new skill; at first you'll likely suck at it and want to give up, but with enough effort you can potentially get a lot out of it.

- 3 LINEAR ACTUATORS
- 2G ACCELERATION
- MOVIE COMPATIBLE

$15,000

5/10

D-Box GP-200

The ultimate in next-gen gaming realism.

@ www.wavetrain.com.au

✔ Fun, realistic and unique.

✖ Bulky, impractical and very expensive.

The D-Box GP-200 is a gaming chair that's custom-built around three linear actuators, which when combined can produce up to 2G of acceleration. It's also got mounting spots for your favourite steering wheel or flight simulation setup. You can use the GP-200 to add rumble to other games such as *Crysis*, but you'll get most value from racing games. It can also add a literal kick to your movie watching, with downloadable motion playback for many movies and TV shows.

The chair never feels like it will throw you out, but even with just 4cm of travel on the actuators, it can generate some impressive-feeling angles and really boosts immersion. We're not sure if the real-time motion feedback made us better drivers, but it sure made it a whole lot more fun and was a total flashback to too much time wasted at Timezone as a kid. Realistic flight sim buffs will appreciate not only the banking and dives you can perform in the GP-200, but also hitting turbulence and the excellent bone rattle when you're throttling up a powerful engine.

The GP-200 doesn't come with a steering wheel or flight controls, but if you're dropping cash for an actuated platform you probably already have the rest of the goods. The chair has a 180kg load capacity and itself weighs 70kg. The D-Box GP-200 is one of the few real hardcore gaming setups that's available in Australia through local distributors, but at $15,000 it's not exactly affordable.

AIWI GAMING PLATFORM

AIR MOUSE

ANTI-SMASH WRIST STRAP

$45

7/10

Genius Wizard Stick

Turn your PC into the most expensive Wii ever.

@ www.geniusnet.com

✔ Wireless motion sensing. D-pad lets you play old games.

✖ Few motion games, occasionally screwy, suggestive name

Motion-control consoles such as the Wii can be a great way to do some social gaming, although until recently there just wasn't a good option for the PC. The Genius Wizard Stick might have a fruity name, but it's designed to bring arm-waving fun to your desktop computer gaming.

The Wizard Stick uses internal accelerometers to detect movement, though it also has normal buttons. To ensure you don't Wii-mote it through your monitor, it comes with a suitably hefty wrist strap. While you can just play on your PC, the Wizard Stick is extra fun when connected to your TV through a media PC. It uses the AIWI gaming platform (**www.aiwi-game.com**) and you can play a small range of motion-controlled flash games or the included *Sega Virtua Tennis*. If you have unexpected guests, you can even download an app that lets you turn your smartphone into a second stick.

The Wizard Stick is actually pretty good at sensing movement and accurately translating it into onscreen actions, but it occasionally messes up. It also has a standard D-pad-style gaming control pad that's perfect for playing emulated games from your youth. You can also use the Wizard Stick as an air mouse and with a bit of fiddling, it would make a decent media PC controller.

The Wizard Stick is a fun way to mess around with Wii-style gaming on your PC, but don't expect to use it for 'serious' gaming. At under $50 online, it's worth more than just a look, though.

REDUCES GAMING RESISTANCE

DUAL SPRING HEAD

ANTI-SLIP FEET

$25

7/10

Razer Mouse Bungee

It's like extreme sports for your mouse.

@ au.razerzone.com

✔ Solidly built, it actually works.

✖ Potentially overkill, takes up desk room, not magical.

When it comes to unconventional gaming accessories, you can't get much odder than the Razer Mouse Bungee. The Bungee is basically a specially-built spring, mounted to a very solid base. Be prepared to waste a good 10 minutes pretending it's a bobblehead or trying to launch paperclips. You feed your mouse cord up along the Bungee and slot it into the top. It looks and feels weird at first, and you'll need to spend some time adjusting the free length of the mouse cord to suit your setup.

We've never been particularly plagued by mouse cord issues, but the Bungee promises to help avoid even the slightest twinge that could impact your gaming. To be honest, we thought the Bungee was a bit of a gimmick, but after plenty of use in games, we can actually see the appeal.

The Bungee keeps your mouse cord out of the way at all times and we never had any tangling issues. If you're really active with your mousing, it does start to give more tension than is desirable at the extremes of the motion. The large rubber bottom feet mean the Bungee stays put on your desk, no matter how hard you throw your mouse around.

Will the Bungee transform your gaming? No. However, if you have a cluttered desk, a mouse you love with a stiff cord or just like gaming gadgets, the Bungee is a decent buy considering it's only $25 from the Razer store. APC

POWER ROUTERS

Looking for a router to satisfy the tinkerer or speed demon in you? Nathan Taylor tests the latest enthusiast models.

For most people, a router is a functional appliance. You configure it for your ISP, set up wireless security and then bury it somewhere out of sight.

Some people want the best from their routers, however: more speed, better responsiveness, file and printer sharing, VPNs, Quality of Service (QoS) settings for gaming and voice. If you're looking for a router with something more than the $100 cheapies you get at the local electronics store, read on.

WHAT THEY OFFER

We've reviewed some of the best ADSL and broadband routers available right now. The top-end models often cost twice as much (or more) as the basic entry-level ones. You may be wondering what you get for all that extra money.

The first answer is speed. You should look for a router that supports Gigabit on all wired ports (WAN and LAN) and dual-band wireless. Wireless speeds also tend to be faster in high-end routers, with support for the new 450Mbps wireless N standard as well as simultaneous dual-band support. The latter means that the router can work in either the 2.4GHz or 5GHz radio spectrum, and switching bands can avoid interference.

They also tend to have more memory and faster processors, which allows them to filter packets faster and provide better throughput.

When it comes to ADSL modem routers, now is a very good time to start looking for a hybrid. All the products we've reviewed here either have a standard WAN port in addition to their ADSL modem port, or one of the LAN ports can be reconfigured as a WAN port. This is important because the NBN is coming. Most ADSL routers will have to be thrown away and replaced when the NBN comes to your town; if your router has a WAN port, you can still use it.

Specifically, any router that wants to be supported on the NBN needs to have a Gigabit WAN port. All the devices reviewed here are NBN-ready.

You may be wondering why you need a Gigabit port for the NBN, when the top-speed consumer service is 100Mbps. Ethernet isn't 100% efficient – it's 50% efficient on a good day. Thus older routers with only a 100Mbps WAN port will actually max out at 40-50Mbps, which isn't enough to support a 100Mbps fibre broadband connection.

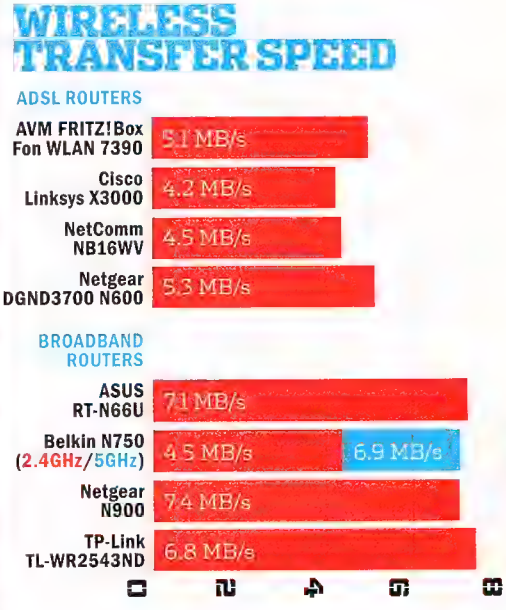
ADSL routers are somewhat behind when it comes to wireless speeds. For whatever reason, 450Mbps wireless, which is available now in broadband routers, is nearly impossible to find in an ADSL router. That might change in the near future, but for now, 300Mbps dual-band is about as good as you get.

There are a host of other features that will separate the top routers from the mediocre ones. Some of the other things we look for include:

- Accessible, logical and comprehensive administrative interface.
- USB ports that support file and printer sharing.
- USB support for 3G modems.
- DLNA/UPnP AV support for media sharing from USB storage devices.
- Integrated Voice over IP (VoIP), with PSTN failover.
- Advanced QoS settings.
- VPN hosting.
- Replaceable antennas.

FILE COPY TESTS

To test the wireless performance of the routers, we performed a simple 1GB file copy test three times between a PC attached to the router by Ethernet and a PC using a wireless connection (we used a Netgear WNDA4100 450Mbps dual-band adapter for these tests, and ran the tests in the 2.4GHz spectrum except for the Belkin, where we ran it at 5GHz, too). The client was 12m from the router, separated by two walls. In the results below, higher is better. We should make two very important notes here. First, these are test results from a specific time and place, and may not reflect what you would get. Most importantly, you shouldn't put too much stock in the results. We were reluctant to even publish them, because wireless performance is a fickle bugger with a huge margin for error. There are so many factors affecting wireless performance that you might get very different results.



UNDER REVIEW

AVM FRITZ!Box Fon WLAN 7390 · Cisco Linksys X3000 · NetComm NB16WV · Netgear DGND3700 N600 · ASUS RT-N66U · Belkin N750 DB · Netgear N900 · TP-Link TL-WR2543ND

$350

9/10

ADSL ROUTERS

AVM FRITZ!Box Fon WLAN 7390

I'll have one with everything.

@ www.fritzbox.com.au

✔ Amazing feature set. VoIP support. USB device support

✖ Expect some sticker shock

If you want a router that does absolutely everything, look no further than the FRITZ!Box, a product with a feature list far too long to list here. Among other things, there's Gigabit Ethernet, dual-band 300Mbps wireless, VoIP and DECT, VPN, twin USB ports with 3G modem support, media sharing and reconfigurable LAN ports.

In additional to ADSL, it can also serve capably as an NBN-ready broadband router. Even if the Coalition wins the next election, cancels the NBN and we get fibre-to-the-node and VDSL, the FRITZ!Box supports that, too.

VoIP has virtually disappeared from routers of late, but AVM is still flying the flag. Not only does it have two ports for analogue phones as well as a failover to PSTN in case of internet outage, it also includes a DECT base station for up to six cordless phone handsets, extensive autodial and messaging capabilities as well as 512MB of internal storage with up to five separate answering machines built in.

On top of all that, there are the two USB ports that support storage devices with media sharing, printers and USB 3G modems. That last one can serve as a backup internet connection.

It's all managed through a relatively logical interface. It doesn't quite hold your hand, but it's easy enough to get things configured.

The only real flaws the FRITZ!Box has is that it's expensive and doesn't support 450Mbps wireless networking; to be fair, though, you'd be hard pressed to find an ADSL router that does.

$160

8/10

Cisco Linksys X3000

Ready for any kind of network.

@ www.linksysbycisco.com

✔ Fast networking, ADSL2+ plus Gigabit Ethernet WAN.

✖ Administration interface not as smooth as Netgear's.

Packaged in the now-familiar Linksys space-age casing, the X3000 is a 300Mbps dual-band wireless ADSL 2+ router with a four-port Gigabit network switch and an additional Gigabit WAN port. That last bit makes it ready for any kind of network you want to throw at it in the future, including the NBN.

Its reception during our testing wasn't quite as good as the other ADSL routers we looked at here. Signal strength was a few dBm lower than the FRITZ!Box and Netgear on average at 12m, and an extended file transfer at that range delivered 4.2MB/s, compared to 5.3MB/s for the Netgear. That's certainly not awful, however, and wireless being what it is, it may well be within the margin of error.

The administration interface puts a lot of features at your fingertips, especially if you want to drill down into the detailed subsections of the firmware. It supports solid file sharing, including DLNA media sharing, from devices attached to its single USB port. It's not the friendliest firmware for beginners, but Linksys supplies router management software that's designed to ensure most users never need to fire up the web interface.

In terms of specifications and price, the Linksys X3000 is a near-perfect match with the Netgear DGND3700 and it's certainly a decent alternative. Linksys doesn't have quite the family friendliness of the Netgear, though, and only a single USB port, which makes the Netgear a slightly better buy.

802.11AC

Although 450Mbps 802.11n is still new, we have an even newer wireless standard coming later this year that will replace 802.11n altogether. 802.11ac is the newest iteration of Wi-Fi, and we'll see the first routers supporting it by the end of the year. 802.11ac technically supports wireless speeds up to 3.47Gbps, although the first routers will likely be limited to 1.3Gbps for multi-antenna clients and 450Mbps for single-antenna devices like mobiles. That's three time faster than the current fastest 802.11n standard.

NetComm NB16WV

$150

7/10

A 3G backup covers you when ADSL goes awry.

@ www.netcommwireless.com

✔ Very good 3G support, VoIP port

✖ Slow LAN ports, only single-band wireless.

NetComm Wireless (formerly NetComm) has really begun to focus its product lineup on 3G solutions. While it still has a range of standard ADSL gateways and broadband routers, if you want to work 3G into your broadband mix, it's certainly worth looking at its range.

The NB16WV is a solid example of what's on offer. It's an ADSL2+ router that has excellent support for attached USB 3G and LTE modems, even supporting failover to 3G in case of ADSL outages. There's a second USB port for storage devices as well.

Like the other ADSL routers here, the NB16W is technically ready for the NBN. It has Gigabit WAN port in addition to its ADSL modem. We say 'technically' in this case, because for some reason NetComm decided to accompany the Gigabit WAN ports with 100Mbps LAN ports. So the router may be able to speak to the internet at 1,000Mbps, but you can only speak to the router at 100Mbps, which is terrible design. It does support 300Mbps single-band wireless, so that might be your best bet if you have a fast NBN service.

There's also a VoIP port built into the router, with support for a single analogue handset. It doesn't support failover to PSTN or nearly as many features as the FRITZ!Box.

Ultimately, the NetComm NB16WV is a router that does a little bit of everything – multiple broadband types, VoIP, wireless and file sharing. It doesn't really excel at anything, however, and it's not our top pick in this category.

Netgear DGND3700 N600

$175

9/10

A combo router with excellent file and device sharing.

@ www.netgear.com.au

✔ Fast wireless, Gigabit Ethernet WAN port, excellent file sharing

✖ Lacking a few higher-end features (like advanced QoS).

The ADSL routers we've reviewed here are also capable of serving as standard broadband routers. The DGND3700 has a Gigabit WAN port in addition to its ADSL2+ port. That makes it ready for when your ASDL connection gets replaced by the NBN.

Another particular strength of the DGND3700 – and of Netgear routers is general – is the support for media and file sharing from USB storage devices. Using Netgear's ReadyShare, you can easily stream media from an attached USB storage device to an Xbox 360, PlayStation 3 or DLNA TV set. It works very well, even talking to a notoriously finicky Samsung DLNA TV set when we tested it.

The Netgear is also notable for its family-friendly features. It's among the easiest routers to set up, with a smooth interface and comprehensible wizards. It also has excellent live parental controls – not just setting internet access times, but also blocking known undesirable web sites. There's a broadband usage meter to track how much you've downloaded in a given period; unfortunately, this doesn't support per-user metering.

The Netgear's four LAN ports are all Gigabit and it supports 300Mbps dual-band wireless, which is about as good as you'll get in an ADSL router. It provided excellent reception when we tested it – at 12m and through several walls, it streamed data at an average rate of 5.3MB/s to a test PC, which is a good result relative to other devices we tested in the same scenario.

BROADBAND ROUTERS

ASUS RT-N66U

Top speeds and tons of features.

@ www.asus.com.au
✔ Lots of features for home and SMBs, very fast
✖ Kind of expensive.

The ASUS router lineup was stagnant for quite some time, but it recently came roaring back into the fold with a range of new designs and products. At the top of the new performance range is the RT-N66U, which supports dual-band 450Mbps wireless, Gigabit LAN and WAN and much more. It tested slightly slower than Netgear's WNDR4500 when we performed a wireless copy test, but it was well within the margin of error.

It may not be just the performance elements that draw users to the RT-N66U, however. There are built-in features not commonly found in consumer routers, including integrated BitTorrent downloading and VPN host/server support using Microsoft Point-to-Point Encryption (MPPE). There are two USB ports in the router and they can be used for file sharing (including SMB and DLNA), printer sharing or for attaching a USB 3G modem as a backup internet connection device.

It also has external detachable antennas, which is actually a pretty rare luxury in a modern router. Sure, it's not as pretty as integrated antennas, but if you're having reception problems you can switch out the supplied antennas for larger ones.

It's all managed through a slick interface with an excellent help system. ASUS is one router vendor that's realised web management interfaces don't have to look like they were made by computer engineering students in the 1980s. The QoS management features are particularly strong.

Belkin N750 DB

Routers don't always have to be ugly.

@ www.belkin.com/au
✔ Looks good, logical management interface.
✖ Only 300Mbps in the 2.4GHz band.

Good-looking routers are a rare thing. Most range from mildly to aggressively ugly; however, Belkin has designed a router that you might be more inclined to leave in the open with its N750 DB F9K1103au; its Art Deco styling might not be to everyone's taste, and it's still going to have a bunch of wires sticking out of the back, but at least Belkin is trying.

It's not as fast as the other broadband routers here. All of its wired ports are Gigabit, but the N750 in the name gives a clue as to its wireless performance: it supports 450Mbps in the 5GHz band, but only 300Mbps in the 2.4GHz band. That's great if you intend to use the 5GHz band, but not so much if you're relying on the regular old 2.4GHz spectrum.

It's not a product that's heavy on the frills, either. Belkin's administration interface is smooth, logical and straightforward, but there aren't hidden depths and super-advanced features to be found. It supports media and file sharing from storage devices attached to its two USB ports – it worked perfectly with an Xbox 360 when we tested it – and it also comes with a small suite of additional networking tools. The latter probably won't be all that useful for somebody looking at an enthusiast router, however.

The Belkin N750 is one smooth package. It's not as feature-rich as the other routers here (especially the ASUS RT-N66U), but it looks good and is simple to manage. That's something not a lot of routers can boast.

Netgear N900

It's fast. Real fast.

@ www.netgear.com.au ✔ Very fast for both wired and wireless, excellent file sharing capabilities. ✖ Expensive.

Netgear's N900 WNDR4500 is built for speed. It's not a looker and doesn't come with a whole mess of highly configurable filtering and service quality elements, but it does deliver the fastest networking available. That includes 450Mbps wireless in both 2.4GHz and 5GHz bands and Gigabit wired networking on both the LAN and WAN ports.

At 12m, through several walls, in relatively tough wireless conditions, it transported data at 7.4MB/s when we tested it. That may not sound like much, but Netgear's own DGND3700 only managed 5.3MB/s in the same conditions.

Like the DGND3700, the N900 features excellent firmware, specially designed with non-technical users in mind. Using the setup CD or web wizards, it gets up and running without you having to face any tough questions. The web admin interface also lets you set up ReadyShare, which lets printers and storage devices attached to the Netgear's two USB ports be made available to devices around the home. As we mentioned in the DGND3700 review, it's an excellent system and our favourite of the file-sharing services available in the various router models we've looked at.

The router also features bandwidth monitoring and live parental controls, which could prove very useful for users in family situations.

It's a very expensive router, with an RRP of $369, but it has one of the smoothest router software designs we've seen. We should also note that the street price tends to be much lower than the RRP, with the N900 available for as little as $230 at the time of writing.

TP-Link TL-WR2543ND

An ultra-cheap router with maxed out networking speeds.

@ www.tp-link.com.au ✔ Amazingly cheap, NBN-ready, fast local networking. ✖ The administration interface needs a lot of work.

If you want the fastest local area and wireless networking tech available at the lowest cost, the TL-WR2543ND is your answer. Available in some stores for less than $100, it delivers both Gigabit LAN and 450Mbps simultaneous dual-band wireless. Its wireless reception wasn't as good the Netgear and ASUS routers in our tests, but your mileage may vary.

It'd be fair to call the admin interface retro, which is really just another way of saying 'bad'. If you're a hardcore networking geek, you might find its bare-metal approach appealing, but beginners – and even users with moderate technology knowledge – may find it challenging. Fortunately, there's a basic setup wizard and CD, which gets the basics of wireless and internet connectivity happening.

The feature set on offer is solid, however. The router has a USB port, which can be used to share files through FTP, Windows File Sharing or DLNA/UPnP AV; the setup for the latter isn't pretty, but it worked with an Xbox 360 when we tested it. It also supports printer sharing. There are quite configurable QoS settings as well.

Ultimately, the reason you'd buy the TP-Link isn't for the capabilities of its firmware, but for the outstanding hardware at an extremely low price. It would make an excellent target for third-party firmware like DD-WRT or Tomato, although it's new and unique enough that most third-party firmware support is still sketchy. At the time of writing, it was reported that OpenWrt was functioning on the TP-Link, but not DD-WRT. apc

SUPERCHARGE YOUR ROUTER

Installing third-party firmware can unlock features in your router that you didn't know it had. Nathan Taylor reveals how.

One of the little secrets of the router business is that nearly all routers are built using common chips. In much the same way that nearly all graphics cards are built using AMD or Nvidia chips, most routers use a limited set of chips – from Broadcom or Qualcomm Atheros. Because nearly all routers share one of these common chipsets, you can actually have generic firmware that can replace the factory-supplied one.

This is where DD-WRT comes in. DD-WRT (**www.dd-wrt.com**) is a Linux-based firmware for common router chipsets. It replaces your manufacturer's router firmware and is popularly put on older spare or secondary routers. Why would you do this? Because DD-WRT enables a host of features that you don't commonly find in consumer routers. VPNs, VLAN segmentation, transparent LANs, wireless transmit power tweaking, commercial hotspots and wireless bridging are just some of the features that DD-WRT has that the router probably originally didn't come with.

We should insert a warning here for people who are of a less technical bent: installing and using DD-WRT is not for the faint of heart. There are no easy setup wizards, no install CDs and no instruction manual (just a wiki and forums on the web site). That said, you don't need to be an absolute expert either. If you can manually configure your router now using its web interface, without resorting to easy setup wizards or install CDs, you can probably manage the configuration of DD-WRT.

WILL IT WORK ON MY ROUTER?

The answer to that question is 'probably', but you need to be sure before you try to install it. The one caveat with DD-WRT is that it won't work on modem routers – that includes ADSL modem routers. It's designed for routers with a standard WAN port; it doesn't have modem support at all.

To find out if your router is supported, head over to **tinyurl.com/y9a9kq5**. Here the DD-WRT site has a searchable list of known supported router models. If your router isn't listed, it still might work, but you may be entering some dangerous territory, since it won't have been tested on your router. There's a guide to checking whether your router will support the firmware at **tinyurl.com/ykxl8tl**.

BEST ROUTERS FOR DD-WRT

If you're looking to acquire a new router to run DD-WRT on, the best supported brands are Cisco Linksys, Netgear, D-Link and ASUS. Setup is often easiest on Linksys and Netgear routers.

INSTALLING DD-WRT

Without question, installing DD-WRT is the trickiest part of the whole exercise. Every router is different and if you get the installation process wrong, you can most definitely turn your router into a fancy doorstop. That's why it's very important to read the guides on the DD-WRT site before you start.

The first thing to do is choose which version of DD-WRT you want to install. There are more than a dozen different versions, with various iterations including or excluding certain features (like VPNs or VoIP, for example). When you perform a model search on the DD-WRT site, it will give you a list of and links to supported firmware for your particular router model. If you want everything, you can just go for the 'Big' or 'Mega' firmware installs.

Once you've downloaded the .BIN file of the firmware version you want to install, you need to check the install process for that particular router. You can find step-by-step instructions for many routers at **tinyurl.com/cln5saj**.

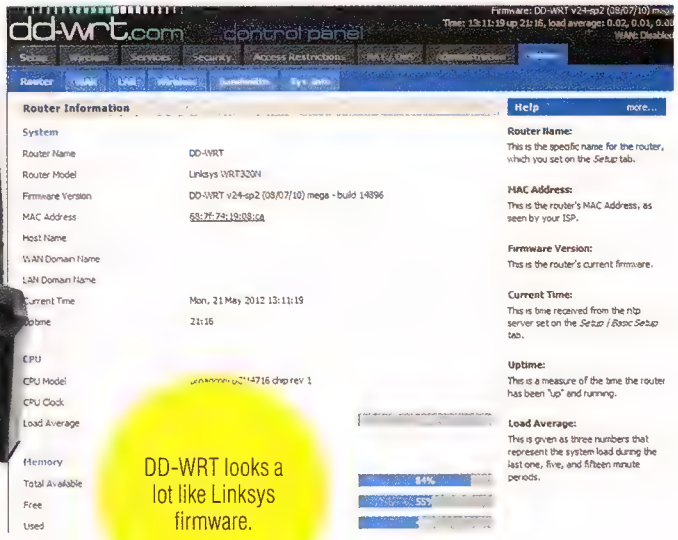
Generally speaking, installation will first involve reverting your existing firmware to factory conditions, using the 30/30/30 method. On the back of your router there'll be a small reset button, possibly recessed and only accessible with something pointy like a paperclip. While the router is on, press and hold that button for 30 seconds. Then, while still keeping the reset button pressed, unplug the power from the router and continue to hold the reset button for 30 seconds after that. Still holding down the reset button, plug the router back in and continue to hold the button for another 30 seconds. After that, your router should be back to initial factory conditions.

The next step depends on your router. If you're lucky, the router is open and can simply be updated through the web GUI. This means logging on to the router admin page (remember that it will be reset to its factory default IP address, username and password), going to the firmware update page and selecting the .BIN file you downloaded from the DD-WRT site. Then you just wait while the firmware is updated. While you're waiting, don't close the browser window or turn off the power to your PC or router; if the update process is interrupted, you'll possibly destroy your router. The best idea is to take a deep breath, step away from your computer and restrain any children and pets while the firmware update is in progress. It will take a few minutes.

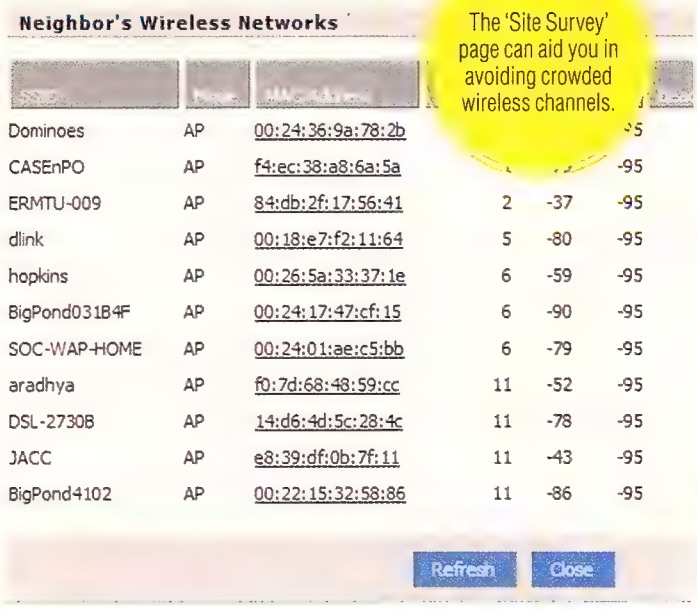
If you're not quite as lucky, you might have to instead install

> TAKE A DEEP BREATH, STEP AWAY FROM YOUR COMPUTER AND RESTRAIN KIDS & PETS

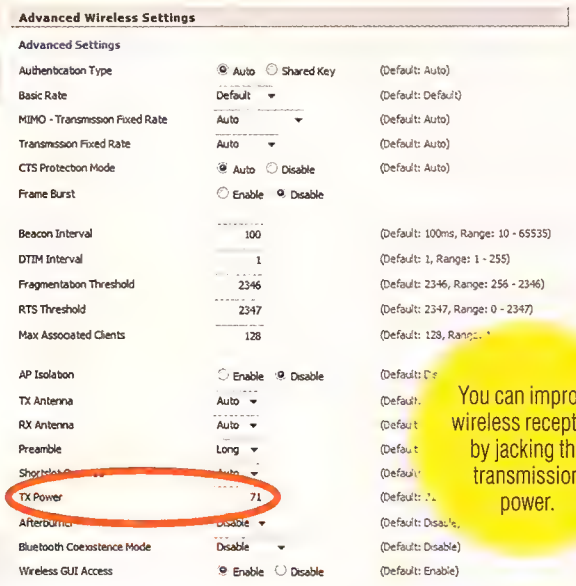
The Linksys WRT54G router, the model for which the open firmware was first built and from which it gets its name.



DD-WRT looks a lot like Linksys firmware.


Neighbor's Wireless Networks
Dominoes AP 00:24:36:9a:78:2b
CASEnPO AP f4:ec:38:a8:6a:5a -95
ERMTU-009 AP 84:db:2f:17:56:41 2 -37 -95
dlink AP 00:18:e7:f2:11:64 5 -80 -95
hopkins AP 00:26:5a:33:37:1e 6 -59 -95
BigPond031B4F AP 00:24:17:47:cf:15 6 -90 -95
SOC-WAP-HOME AP 00:24:01:ae:c5:bb 6 -79 -95
aradhya AP f0:7d:68:48:59:cc 11 -52 -95
DSL-2730B AP 14:d6:4d:5c:28:4c 11 -78 -95
JACC AP e8:39:df:0b:7f:11 11 -43 -95
BigPond4102 AP 00:22:15:32:58:86 11 -86 -95
Refresh
Close

The 'Site Survey' page can aid you in avoiding crowded wireless channels.


Advanced Wireless Settings
Advanced Settings
Authentcation Type Auto Shared Key (Default: Auto)
Basic Rate Default (Default: Default)
MIMO - Transmisson Fixed Rate Auto (Default: Auto)
Transmisson Fixed Rate Auto (Default: Auto)
CTS Protecton Mode Auto Disable (Default: Auto)
Frame Burst Enable Disable
Beacon Interval 100 (Default: 100ms, Range: 10 - 65535)
DTIM Interval 1 (Default: 1, Range: 1 - 255)
Fragmentaton Threshold 2346 (Default: 2346, Range: 256 - 2346)
RTS Threshold 2347 (Default: 2347, Range: 0 - 2347)
Max Associated Clients 128
AP Isolaton Enable Disable
TX Antenna Auto
RX Antenna Auto
Preamble Long
TX Power 71
Bluetooth Coexistence Mode Disable (Default: Disable)
Wireless GUI Access Enable Disable (Default: Enable)

You can improve wireless reception by jacking the transmission power.

an intermediate firmware, usually with a .CHK extension. This performs the initial overwrite of the factory firmware and preps your router for the full installation. If you need to do this, it will tell you on the hardware-specific setup section of the DD-WRT site. It will also contain links to the intermediate firmware.

A handful of routers might require even more exotic setup methods, like resorting to using TFTP software to manually inject the firmware onto the router.

FIVE COOL THINGS YOU CAN DO

Now that you have DD-WRT installed, it's time to play. The default IP address for DD-WRT's web admin is 192.168.1.1, the default username is 'root' and the password is 'admin'. First, you should set up the basic router settings: WAN connection, wireless settings and security and the like.

But then you can start to delve into the cool stuff: the features that your router didn't have before. There are a lot – too many to cover here – but here are our top five favourite features of DD-WRT and how to use them.

01 BOOST & MONITOR WIRELESS SIGNALS

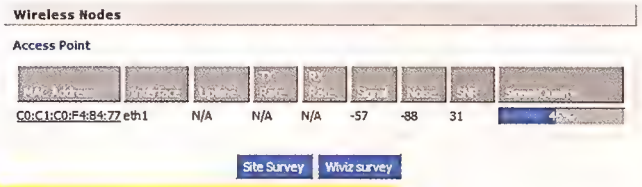
A lot of people install DD-WRT for one thing: the ability to heavily tweak wireless settings. In particular, you can increase your router's wireless transmission power, potentially extending the range of the router. You can also perform a site survey and get detailed information on wireless performance.

First up, you can increase the power of wireless signals by 'overclocking' the transmit power from your router. For example, on a Linksys WRT320N, the default wireless transmit power is set to 71mW. By going into the 'Wireless > Advanced Settings' tab, you can modify the 'TX Power' (that's transmit power) setting up to 251mW, which can give a major boost to the range of the router.

There are two things to note here: this is only transmit power. Your wireless devices still have to be able to talk back to the router, so it's not a panacea; that said, most traffic tends to be downstream, so there are definite benefits to having a high transmit power. The second is that setting the transmit power too high can induce wireless noise and overheat the router. Don't automatically max out the 'TX Power' setting: if your wireless reception is fine, just leave the settings as default.

DD-WRT also provides excellent feedback on just how well your connected devices are doing. Go to 'Status > Wireless' and at the bottom of the window you'll see a list of connected devices and their signal-to-noise ratio (SNR) in dB. If you're looking to manoeuvre your router for the best reception, this is invaluable feedback. A SNR of 40+ is excellent, 25-40 is good and less than 15 is a problem.

On the same page, you'll find the 'Site Survey'. This reveals other networks in the area and what wireless channel they're using, which is handy for selecting your own wireless channel to avoid overlap.

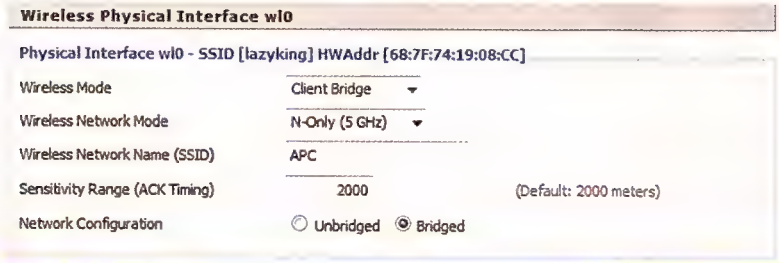


A good SNR is vital for wireless signal quality.

02 CLIENT BRIDGE & WIRELESS REPEATER

If you have devices that have an Ethernet port, but not wireless (like many DLNA TVs, desktop PCs and game consoles), you can set up DD-WRT as a client bridge. This sets up the router to work as the wireless client of another access point or router. Everything coming over the wireless network is piped to the DD-WRT router's LAN ports and vice versa. Thus it allows you to connect your wired device to the wireless network. As an added bonus, routers tend to have better reception and antennas than a regular mobile wireless device, so speeds will likely be very good.

DD-WRT also supports standard WDS, which can solve wireless signal strength problems by using the router to retransmit wireless signals. Then there are the repeater and repeater bridge modes, which are excellent alternatives to WDS, especially if you don't have admin access to the main router or need to have all clients on the same subnet. You can set up both client bridge mode and repeater (WDS) mode in the 'Wireless > Basic Settings' section of the router. There's a great guide to the differences here: **tinyurl.com/m9l2ot**.

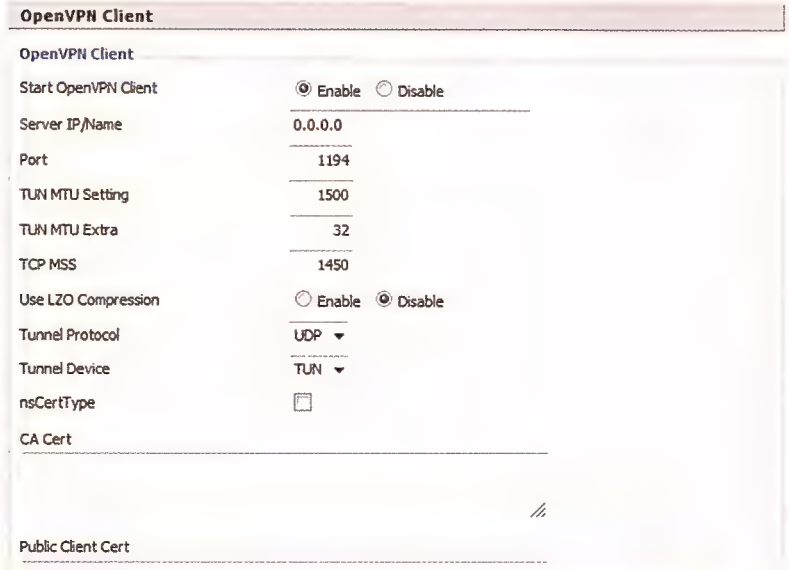


Client bridge mode lets you repurpose your router to let wired-only devices (like game consoles or smart TVs) use it to connect to your existing wireless network.

03 VPNS

VPNs (virtual private networks) aren't something normally found in consumer routers – you generally have to fork out for a higher-end security router if you want to build encrypted tunnels to transmit data between networks and devices across the internet.

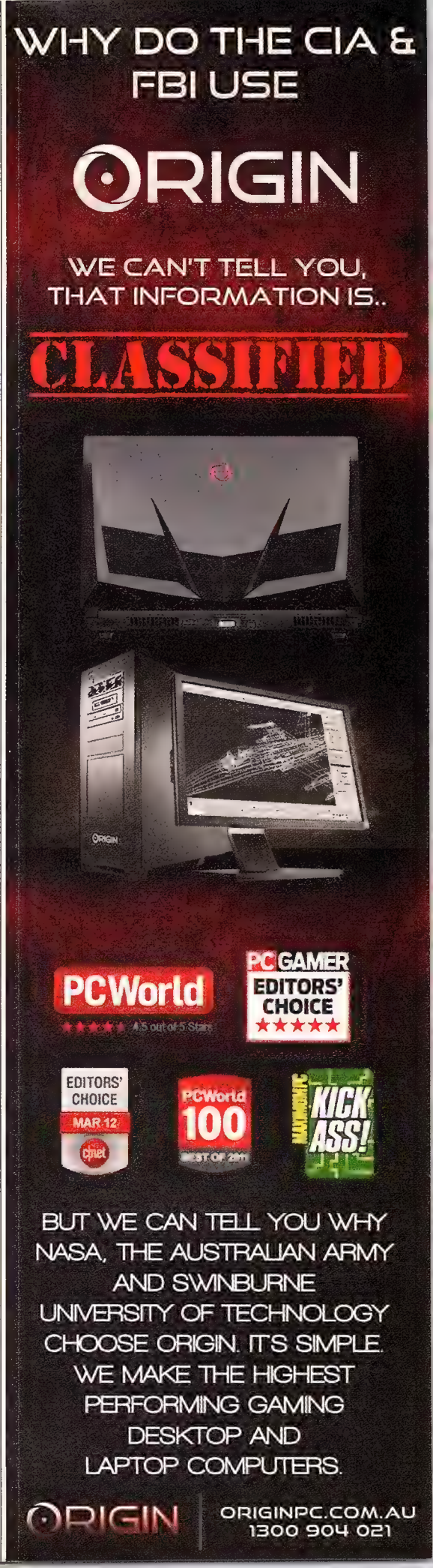
As well as a PPTP server and client, many builds of DD-WRT include support for OpenVPN, allowing complex VPN structures to be implemented. Peers can authenticate with pre-shared keys or public/private certificates, and tunnels are encrypted using industrial-strength SSL encryption. It's a very powerful system, although it may prove to be challenging for a beginner.



VPNs: scary stuff for beginners. Configuration can be found in 'Services > VPN'.

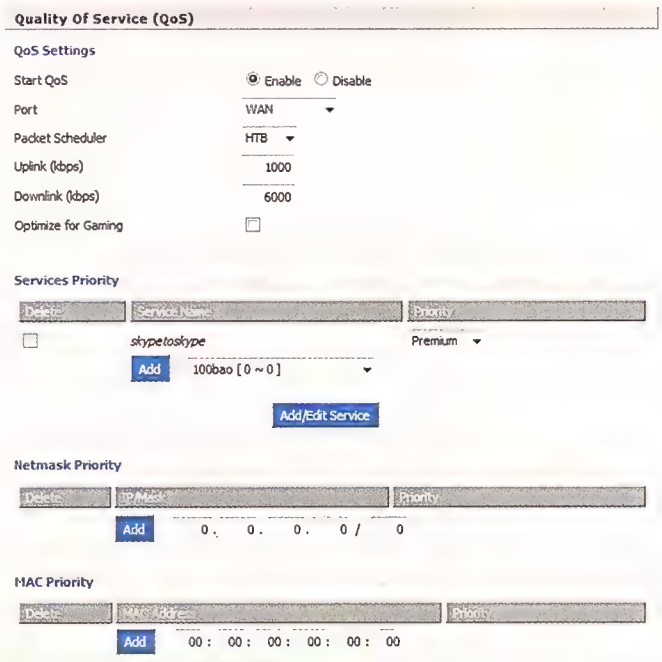
04 BANDWIDTH MANAGEMENT

There are sophisticated QoS (Quality of Service tools) and bandwidth management tools built into the firmware. Head over to 'NAT/QoS > QoS' to set up QoS rules for your network. You can specify reserved bandwidth and set routing priorities for individual services (based on service type or port number) or users (based on MAC address or IP range). It requires a good chunk of work to be done in order to set it up, but it's more flexible than any alternative we've seen. You can also set global or per-PC access restrictions on certain services and web keywords. For example, you can determine that *Battlefield 2142* is only playable between 10am and 12pm on Sundays, that P2P traffic will always be filtered or that all sites with the word 'snizzles' be inaccessible at any time.

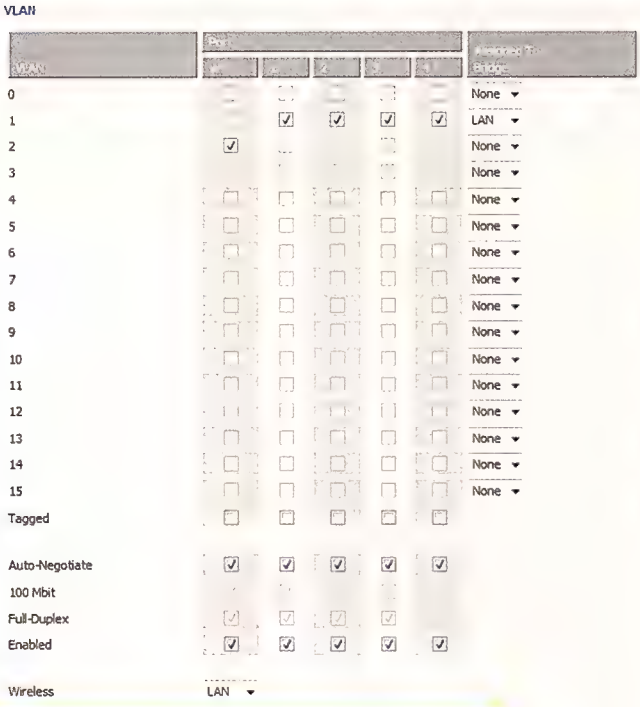

WHY DO THE CIA & FBI USE
ORIGIN
WE CAN'T TELL YOU, THAT INFORMATION IS..
CLASSIFIED
PCWorld
4.5 out of 5 Stars
PC GAMER
EDITORS' CHOICE
EDITORS' CHOICE
MAR 12
PCWorld
100
KICK ASS!
BUT WE CAN TELL YOU WHY NASA, THE AUSTRALIAN ARMY AND SWINBURNE UNIVERSITY OF TECHNOLOGY CHOOSE ORIGIN. IT'S SIMPLE. WE MAKE THE HIGHEST PERFORMING GAMING DESKTOP AND LAPTOP COMPUTERS.
ORIGIN
ORIGINPC.COM.AU
1300 904 021

OTHER FEATURES YOU CAN EXPLORE INCLUDE CREATING PUBLIC WIRELESS HOTSPOTS

You can find these settings in the 'Access Restrictions' tab.



DD-WRT has very powerful QoS settings.



DD-WRT lets you segment different users into virtual LANs.

05 VLANS

It's possible to set up distinct virtual LANs in DD-WRT. This segments data, preventing certain users from talking to each other, or wireless users from talking to LAN users. Go to 'Setup > VLANs' and by moving the tick boxes around, you can create virtual LANs in which users can only talk to other users on their LAN segment.

As an added bonus, you can reclaim the WAN port as an extra LAN port if you're not using it, such as might be the case if you're using the router as a dedicated wireless access point/switch. On the main 'Basic > Setup' page, just check the 'Assign WAN Port to Switch' box.

OTHER FEATURES

There are many other features you can explore with DD-WRT.

- Web-based wireless authentication with Sputnik or ChilliSpot, which can be used to create public wireless hotspots where users sign in from a web page. Head to 'Services > Hotspot'.
- File, printer and scanner sharing from devices attached to USB ports. You can find it at 'Services > USB and Services > NAS'.
- XLink Kai, which is a service that allows you to play system-link console games over the internet. Find it in the 'Services' tab.
- Use a 3G/LTE modem or tethered phone for WAN connectivity. If you've enabled USB (in 'Services > USB'), '3G/UMTS' should become a 'Connection Type' option in the 'Basic Setup'.
- Bandwidth monitoring. Head to 'Status > Bandwidth' for a graphical view of bandwidth usage on the device.
- Wi-viz, which provides a map of local wireless devices.

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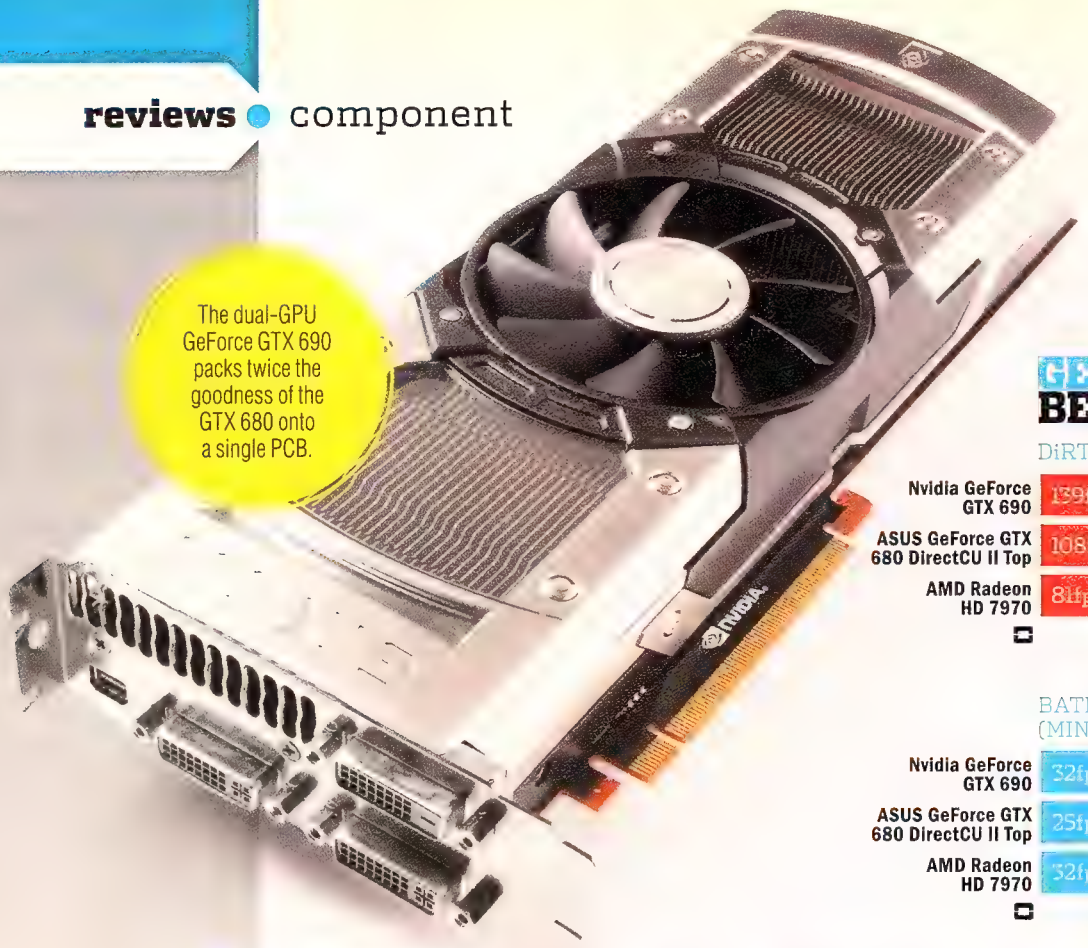
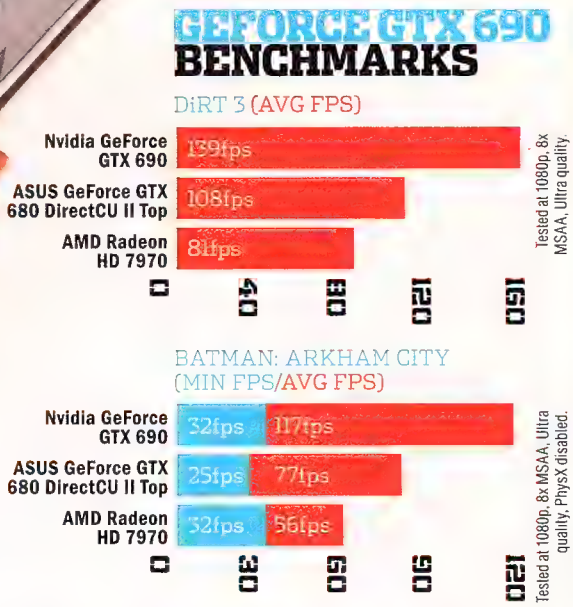


The dual-GPU GeForce GTX 690 packs twice the goodness of the GTX 680 onto a single PCB.



8/10 Nvidia GeForce GTX 690

Two heads are better than one.

www.nvidia.com @
From $1,494 $
Incredibly powerful, whisper quiet, can be used in SLI. ✔
No HDMI, stupidly expensive. ✖

Despite being built with notebooks in mind, Nvidia's new Kepler architecture has done wonders for desktop graphics cards. With its meagre energy needs and high performance, gamers have been blessed with a powerful product that doesn't sound like a Black Hawk lifting off. The first card based on this new architecture was the GTX 680 and our review (see *APC* June, page 56) showed it to be the fastest single-GPU video card on the planet. Now, Nvidia has released the bruiser of the Kepler bunch, the dual-GPU GeForce GTX 690, packing twice the goodness of the GTX 680 onto a single PCB.

Unlike earlier dual-GPU solutions from Nvidia, both GPUs on the GTX 690 are identical to the GPU on the GTX 680. While the boost frequency has been dropped by around 3%, all of the CUDA cores are present and accounted for. This gives the GTX 690 almost identical performance to two GTX 680 cards running in SLI mode and it's record-breaking.

Nvidia's past dual-GPU video cards were incredibly noisy, the single cooler removing the heat of two GPUs at 95°C. But Kepler is different, running much cooler than expected. The GTX 690 is whisper quiet, even when under load.

Two eight-pin power connectors feed the card, but you won't need a stupidly powerful PSU to run it; we had no issues using an affordable 750W Cooler Master PSU. The card is 11in in length, which is reasonable, and only eats up two slots.

A whopping 4GB of onboard memory is included in the form of GDDR5, more than enough even for those gaming at 2,560 x 1,600 resolution. Our reference card shipped with three DVI-out ports and one mini-DisplayPort, with not an HDMI port in sight. This seems a strange oversight, but DVI-to-HDMI adapters are only around $10 each.

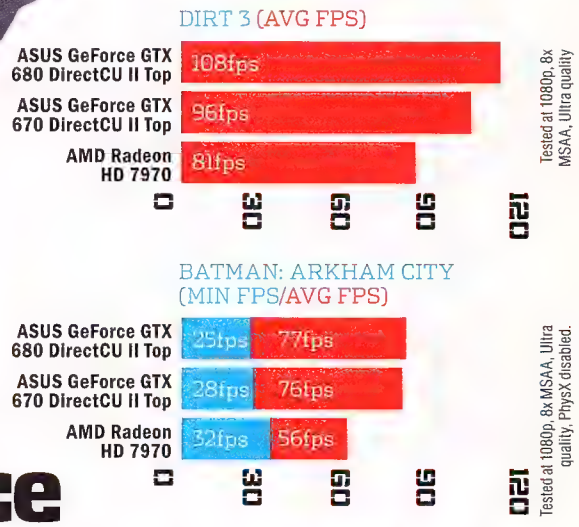
As expected, performance was staggering, wiping the floor with every graphics card that has ever graced our Labs. This is truly the fastest video card ever made. The performance lead over the GTX 680 ranged from 28% faster in *DiRT 3* up to 57% faster in 3DMark 11. Due to time constraints we were only able to test at 1,920 x 1,080-pixel resolution, but Nvidia's benchmarks show the performance lead will increase further at 2,560 x 1,600.

There are only two problems with this über card: pricing and availability. Despite Nvidia's claims that Kepler yields are high, GTX 680s are rare. The GTX 690 is even harder to find. The second problem: price. Despite the RRP of US$999, current street pricing in Australia is hovering around the $1,500 mark, making it much more expensive than a pair of GTX 680s. With two GTX 670s for 60% of the price and 85% of the performance, the GTX 690 is only for those with money and monitor resolution to burn.

Bennett Ring

Cheaper than its bigger brother, but with similar levels of performance, it's a winner.

ASUS GEFORCE GTX 670 DIRECT CU II TOP BENCHMARKS



ASUS GeForce GTX 670 DirectCU II TOP

10/10

Insane performance at a very sane price.

www.asus.com.au @
$615 $
Excellent performance, default version is a solid overclocker, whisper quiet operation. ✔
Stock availability may be an issue. ✖

APC MAGAZINE apc EDITOR'S CHOICE

We've always had a soft spot for the middleman in Nvidia's performance GPU family, starting with the GeForce GTX 470, following up with fond memories of the GTX 570. These products have traditionally aimed for the high-end gamer who can't afford the best of the best, but still wants enough performance to crank the detail settings to Ultra. With the release of the GTX 670, that performance is better than ever, as this card hasn't suffered the extensive hobbling of prior versions.

The GTX 670 uses the same GK104 processor found in the GTX 680 and 690, but one of the eight SMX clusters has been disabled. Other than that, everything else remains intact. The same 2GB of GDDR5 memory is clocked the same as the GTX 680 at a blistering 1,502MHz, quad-pumped to deliver an effective 6,000MHz. The vanilla GTX 670's GPU core frequency has been slightly slowed, clocking in with a maximum boost speed of 980MHz, slightly down from the 1,125MHz we've seen on the GTX 680. As seen with this variant's factory overclock, however, the GTX 670 can easily be tweaked to run at basically the same speed as its big brother.

We can expect to see a variety of coolers on the many different GTX 670s, and ASUS has decked out its version with the dual-fan DirectCU II TOP cooling solution. Even with the overclocked GPU running under load at 1,125MHz, we could barely hear this dual-slot cooler doing its job, and we're sure even running two of them will remain whisper quiet.

Given the excellent cooling, we'd hoped to see better overclocks, but we could only squeeze an extra 50MHz out of the chip and another 100MHz out the memory.

Our review sample came packing twin DVI outputs, along with a single HDMI and DisplayPort out. All four can be used at once, courtesy of Nvidia's 3D Vision Surround tech.

To test how close the GTX 670 is to the 680, we put it through our standard GPU benchmarks. It should be noted that this version of the GTX 670 will be slightly faster than a default GTX 670, thanks to the ASUS factory overclock. Tweaked or not, it's hard not to be impressed by the numbers. In both 3DMark 11 and *DiRT 3*, the GTX 670 was just 10% behind its bigger brother and well ahead of AMD's fastest card, the Radeon HD 7970. We were amazed when the GTX 670 went on to equal the GTX 680 in the demanding *Batman: Arkham City* test.

Considering the GTX 670 can be had for around 30% cheaper than its big brother (the street price is considerably cheaper than the RRP), yet offers most of the performance, we have to give it the nod of approval. In fact, we were so impressed with it that this author decided to buy two 670s for a new SLI setup. You can't get a bigger seal of approval than that.

Bennett Ring

8/10

MSI R7970 Lightning

A great example of AMD's top card.

au.msi.com @
$679 $
The highest-performing AMD card on the market today. ✔
GPU Reactor can be a nuisance when running CrossFire. ✖

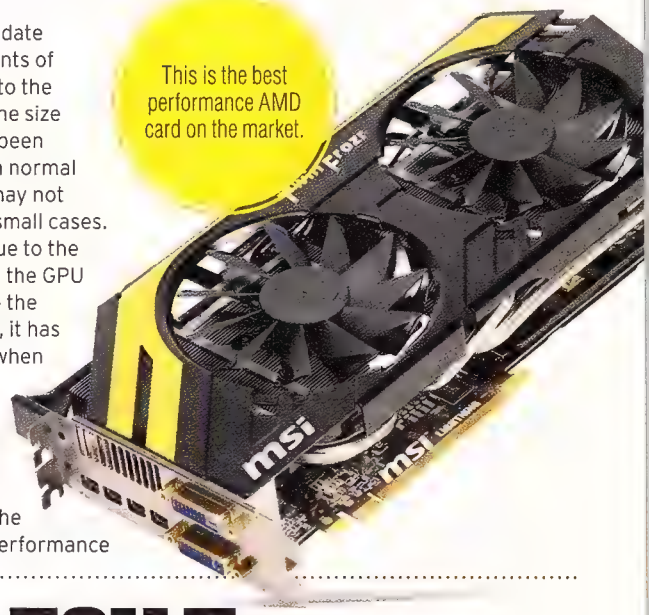
Since the inception of the MSI Lightning brand, it's been a favourite with enthusiasts. Higher frequencies, better cooling and best-in-class power delivery – what's not to like?

The Lightning 7970 has picked up where the Lightning 580 left off, but with a few new features for good measure. Back again are MSI's critically acclaimed Military Class III components, delivering extremely stable power, helping extend the lifetime of the card. A new addition to the Lightning 7970 is an expansion board dubbed GPU Reactor – this promises cleaner power, which can be critical when squeezing that last few MHz out of a card. The biggest enemy of achieving high frequencies is heat, which MSI has addressed by donning the card with its Twin Frozr heatsink, a massive dual-fan cooler, which is more than capable of dissipating any heat thrown its way. Not content with the stock frequency of 925MHz, MSI has bumped it all the way to 1,070MHz, but from our experience there's still some MHz left in the tank for those keen on overclocking.

To accommodate excessive amounts of power delivery to the componentry, the size of the card has been extended over a normal 7970, but this may not suit users with small cases. Furthermore, due to the increased width the GPU Reactor adds to the rear of the card, it has to be removed when the cards are placed in three- or four-way CrossFire configurations.

If you want the absolute best-performance AMD card on the market, you can't go past the 7970. As far as we're concerned, the MSI Lightning is the new king of the 7970 crop.

James Trevaskis



7/10

Intel DZ77GA-70K Extreme

A solid board that lacks a killer punch.

www.intel.com.au @
$260 $
The BIOS is incredibly easy to use. ✔
When will Intel learn that skulls aren't cool? ✖

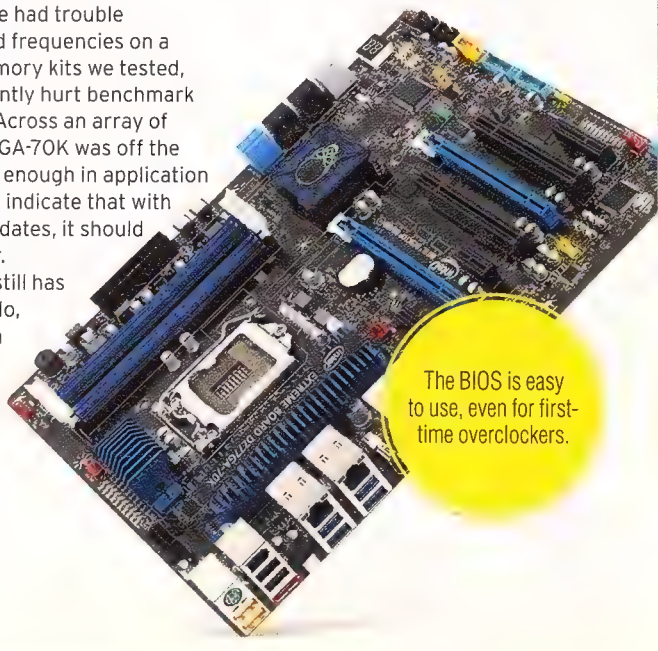
It seems like Intel has been trying to make a quality enthusiast motherboard forever, but for equally as long, critics have been harsh on the end result. The latest iteration in the Intel enthusiast line-up is the Intel DZ77GA-70K, a Z77-chipset offering that has all the makings of a great board.

The Z77 has two full-length PCI-E slots capable of running two-way SLI and CrossFire setups, which are supported by a further three PCI-E expansion slots and a single PCI slot. Also onboard are four DIMM slots that are capable of supporting up to 32GB of memory, dual Intel Gigabit network adapters, eight SATA ports and a massive 18 USB ports and headers, eight of which are on the back IO shield.

The BIOS has no lack of options and is extremely easy to use, especially for those delving into overclocking for the first time. A simple slider gives you the ability to overclock your CPU to 4.5GHz with a click of the mouse, but some other aspects aren't as polished. Memory performance is sub-par, for example; we had trouble achieving rated frequencies on a number of memory kits we tested, which significantly hurt benchmark performance. Across an array of tests the DZ77GA-70K was off the pace, but it did enough in application benchmarks to indicate that with future BIOS updates, it should perform better.

While Intel still has some work to do, this board is an encouraging step in the right direction. For anyone who wants serious performance, this board might not be the best option, although as an affordable, set-and-forget motherboard, the Intel DZ77GA-70K is a great choice.

James Trevaskis



8/10 OCZ Vertex 4 512GB

The first of the Indilinx-powered Vertex drives.

www.ocztechnology.com @
$790 $
Insane random read performance, comparatively inexpensive. ✔
You could still build an entire rig for the price. ✖

OCZ has long been at the top of the SSD market, even culling its memory business to focus primarily on storage. To further solidify its already strong position here, OCZ purchased controller manufacturer Indilinx in late 2011. The Indilinx acquisition not only gives OCZ exclusive access to the best Indilinx technologies, but also promises to reduce production costs, which should (in theory) result in cheaper drives.

This pricey drive offers the best performance available.

The latest in the premium Vertex series is the Vertex 4 512GB, which sports (you guessed it) an Indilinx controller. This is a totally new look for the Vertex, which has traditionally used SandForce controllers. The new Indilinx controller is the Everest 2, which has slightly lower sequential read and write performance than the popular SandForce 2281, but boasts nearly 40% gains in random read operations.

Along with the ridiculous 95,000 random read IOPS (input/output operations per second; a standard measurement used to compare disk speed), the Vertex 4 also features 85,000 random write IOPS, 535MB/s sequential reads and 475MB/s sequential writes. Every time you open an application or play a game, the data is read from random locations on the hard drive – the faster the random read IOPS, the faster your game responds.

Even though the Vertex 4 isn't cheap, the Indilinx acquisition has already made an impact on the price, putting this SSD at a very competitive price point. If you want the best performance available, then you can't go past the Vertex 4.

James Trevaskis

7/10 WD VelociRaptor 1TB WD1000DHTZ

Increased size meets improved performance.

www.wdc.com @
$389 $
Much cheaper per GB than SSDs, still fast for a platter-based drive. ✔
Still a long way behind SSDs for random operations. ✖

There was a time when Western Digital's Raptor drive series was king of the storage hill. Even when SSDs first entered the market, the VelociRaptor was still the drive of choice for many, offering an affordable mix of speed and size.

An excellent reinvention of the Raptor range.

As SSD prices have decreased, however, so has the Raptor's popularity, although we think the latest reinvention may change that.

Focused primarily on multimedia content, the VR333M series comes in 250GB, 500GB and 1TB variants. Sporting 64MB of cache and a sustained transfer rate of 200MB/s, it's admittedly no competition for today's SSDs, but it doesn't claim to be. The Raptor finally knows what it is and that's not a drive that delivers blistering boot and application performance, but one that excels in multimedia applications. Backing up these claims are strong average sequential read and write speeds of 163MB/s and 161MB/s, respectively, almost 30% better than the previous generation.

The biggest drawback is, of course, random operations – both random reads and writes are slower than most SSDs by a magnitude of 20.

The VelociRaptor has another strong asset in its arsenal other than size, however: the price. Even the most affordable 512GB SSDs on the market will cost you over $700, and for 1TB you'll need two of those. The VelociRaptor comes in at close to a quarter of that price, giving it a significant appeal boost as a secondary drive that still offers respectable performance. This drive isn't for everyone, but if you deal with lots of large files on a daily basis, then the latest VelociRaptor might be exactly what you've been waiting for.

James Trevaskis

This board offers good value for money and is packed with features.

ASRock X79 Extreme4-M

7/10

ASRock comes of age.

www.asrock.com @
$249 $
The perfect candidate for an inexpensive portable gaming rig. ✔
The onboard fan is likely to cause issues. ✖

We've always loved ASRock for its ingenuity, and it's released some truly groundbreaking motherboards over the years. Unfortunately, while ASRock has always promised amazing and innovative features, the end result has regularly been disappointing. With the release of this X79 and its Z77 boards, however (see *APC* June, page 44), ASRock has reinvented itself, with more focus on reliability and performance.

The X79 Extreme4-M is the baby of ASRock's X79 board lineup due to its tiny micro-ATX form factor. Visually, it gets a tick of approval, too: it isn't quite a masterpiece, but the gold capacitors contrast against the black PCB and PCI-E slots.

Even with its smaller footprint, the Extreme4-M is still packed with features. ASRock has included four memory slots supporting frequencies up to 2,400MHz. Also on board is a single LAN adapter, four SATA 6Gbps ports and eight USB ports with headers for six more, (four are USB 3.0). We're pleased to find three PCI-E slots, but due to the limited space, there's only support for two-way CrossFire and SLI.

One of the standout features of the whole range of ASRock X79 boards is the quality of components used. From the Japanese capacitors to the beefy 6+2 phase power delivery, these boards are built with a long lifetime in mind. We question the use of a small fan on the PCH heatsink, though. Small fans usually get noisy as they get older and then eventually stop working all together.

It was a pleasant surprise to discover this board overclocks well. The BIOS is intuitive and it didn't take us long to get up and running. It was also fairly forgiving when we set parameters incorrectly. For those who really like to push their PCs, this board's disappointing memory overclocking is a bit of a letdown. It took some effort to get 2,133MHz running stably, while some of ASRock's competitors can easily do 2,300MHz.

Beginning with the 3DMark Vantage performance benchmark, the Extreme4-M compares well to the top X79 boards, coming within 0.5% of the competition. Across the Vantage Extreme, 3DMark 11 and *Crysis* tests, a similar trend continues – it's not at the top of the list, but it's often only a stone's throw behind. The trend rapidly changed when we introduced non-3D benchmarks, however. In both Super PI and bandwidth comparisons, a considerable gap opened between this ASRock and other leading manufacturers' boards.

While we have a few small gripes with this board, it's very solid overall. Taking into account the features, components and price, it's good value for money. It's a huge step forward from ASRock and possibly even the best micro-ATX X79 board on the market.

James Trevaskis

Corsair Vengeance 16GB

7/10

Too inconsistent for our liking.

www.corsair.com @
$165 $
A solid kit, sensibly priced. ✔
Inconsistent performance at high clocks, silly cooling. ✖

Life as a memory vendor is a precarious existence. Take Corsair: its 8GB low-profile Vengeance CML8GX3M2A1600C9W kit is great if you're after dual-channel RAM, while this quad-channel effort (the CMZ16GX3M4X1866C9R) is relegated to also-ran status.

If we're honest, there's not all that much between them though; they're both good kits. So what keeps this 16GB kit from being as good? It's certainly not bandwidth. With a claimed and tested 1,866MHz on offer, there's plenty of that.

It cranks out some solid numbers in most of our benchmarks, too. What it isn't is terribly consistent. At the default 1,333MHz setting, you get an impressive average of 114fps in *World in Conflict*, for instance. That's the highest figure we've achieved, but the problem is the minimum frame rate was 50, which is middle of the pack. Arguably, it's minimums, not averages that count.

Making matters marginally worse, the average frame rate dropped when we upped the ante to 1,866MHz, while the minimum didn't budge. To be fair, this isn't the only kit we've seen that serves up slower numbers when running faster. At least in part, the results may reflect normal testing fluctuations, but the inconsistent performance certainly doesn't help the Vengeance's cause.

Nor do latencies that are a little off the pace of the best. There's nothing wrong with 9, 8, 7, 20. It's very good – it's just that other quad-channel kits often do better, and at a cheaper price. Similarly, we're not impressed by the fancy heat spreaders with tall fins, as they only get in the way of your CPU cooler.

Jeremy Laird

This quad-channel effort is relegated to also-ran status.

G.Skill RipjawsZ 16GB

8/10

Needs to lose those pointless fins.

www.gskill.com @
$120 $
A nice RAM kit at this price. ✔
Watch out for those fins. ✖

The G.Skill RipjawsZ F3-12800CL9Q-16GBXL kit would pass the Pepsi challenge with flying colours. If we lined up two otherwise identical PCs, one with the RipjawsZ and one with our test-topping Kingston HyperX kit, it would take some kind of modern-age hardware guru to feel the difference. Frankly, we'd suspect foul play if anyone could.

But there are still reasons to differentiate, both notional and tangible. The RipjawsZ is a little off the pace wherever you look. Its 9, 8, 8, 20 latencies at 1,333MHz are good, but not spectacular. Its 1,600MHz top speed is similarly useful, but hardly world-beating when you realise the HyperX hits 2,133MHz. The benchmark numbers it cranks out are acceptable, but bettered elsewhere.

On a more tangible note, these are nicely engineered DIMMs with great-looking, albeit tall-finned, heat spreaders. If RAM cooling was a major issue that might be an interesting trade-off in terms of cooling and system configuration, but it isn't, so there's little to be gained by fouling the CPU socket and preventing certain makes and models of CPU coolers from being used. Lower-profile heat spreaders make more sense in today's systems where overclocking is done by dividers. But like we said, this kit is no dud. It's great value at $120. It just loses out in a game of very tight margins.

Jeremy Laird

Great value, but it loses out in a game of very tight margins.

7/10 Kingston HyperX 8GB

Raw bandwidth, but nothing special.

www.kingston.com @
$95 $
Excellent build quality, great speed. ✔
Tall cooling fins. ✖

Kingston has suited and booted this HyperX KHX1866C9D3T1K2/8GX kit in the latest anodised alloy accoutrements. By that we mean hefty heat spreads. The problem is, we're not convinced they're really necessary. Moreover, the only thing we're sure about is that the tall cooling fins can get in the way of some CPU coolers on most motherboards.

We're not against heat spreaders per se, but we definitely prefer the low-profile variety with today's low-voltage memory. On the upside, this Kingston kit comfortably outstripped its quoted top frequency, delivering 2,133MHz with the same 9, 11, 9, 27 latencies claimed for 1,866MHz.

Unfortunately, raw bandwidth aside, going beyond 2GHz doesn't translate into significantly better performance in several of our benchmarks. Its Cinebench score, for instance, edges up from 6.88 points to just 6.89 points, which is distinctly unexciting.

OK, the average frame rate in *World in Conflict* stepped up from 98 to 106fps, but the minimum rate increased by a solitary frame. Similarly, at the default 1,333MHz frequency, latencies of 9, 9, 9, 24 are nothing special, and neither were the performance results.

It's not easy being a premium memory kit, we're happy to admit. Like so many others, this one is good, but not quite great.

Jeremy Laird

Hefty heat spreaders abound in this kit.

6/10 Acer H9500BD

Is it time to upgrade your home theatre?

www.acer.com.au @
$2,299 $
1080p, deep blacks, very bright. ✔
DLP, minor 3D crosstalk, no horizontal keystone. ✖

There's a flood of new 3D projectors hitting the market and this Acer model stands out with features like a full 1080p resolution, a 50,000:1 dynamic contrast ratio and 2,000 ANSI lumens brightness. It's also HDMI 1.4a compatible for 3D content and can convert 2D videos to 3D.

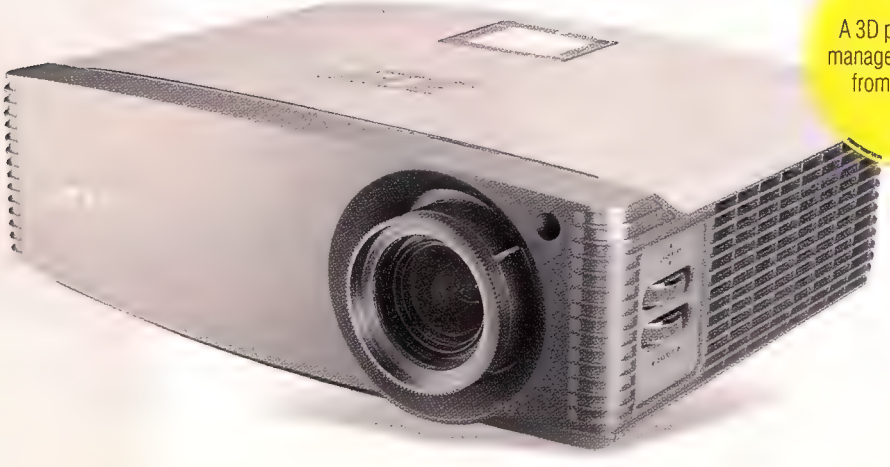
We tested with a 3D Blu-ray player and the overall experience was OK, but it suffered from minor crosstalk and DLP-induced rainbow effect. 3D conversion is great for cartoons and many games, but we found the created 3D texture lacked accuracy for live action.

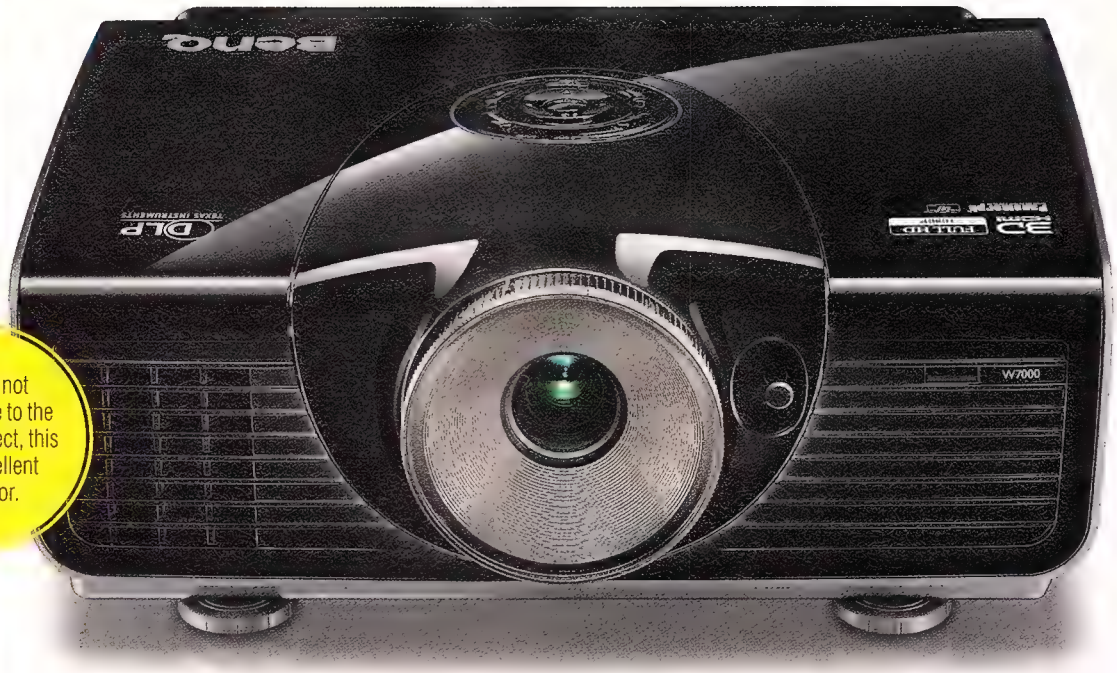
For 2D content the image quality is very good, with a bright, vivid picture and nice deep blacks, thanks to the dynamic iris. It also includes Accumotion, which smooths footage by adding frames; however, we found it quite annoying and left it turned off. The lamp is rated for up to 4,000 hours in eco mode, so you won't need to replace it in a hurry.

The H9500BD also has manual lens shift controls, which lets you move the image around on the wall a small degree, rather than having to move the projector itself. While there's keystone correction (for projecting from above or below), you can't correct off-angle side projection. It does have a zoom lens, though, which makes it very easy to resize to your screen.

Lindsay Handmer

A 3D projector that manages to stand out from the crowd.





If you're not susceptible to the rainbow effect, this is an excellent projector.

8/10

BenQ W7000

At the end of the rainbow is a great projector.

www.benq.com.au @
$2,800 $
Excellent 2D and 3D performance. ✔
Rainbow effect is still noticeable for sensitive viewers. ✖

BenQ is one of the few projector manufacturers in this price range to stick with DLP. Where most favour LCD projection to deliver richer and more accurate colours, DLP still has the advantage when it comes to contrast ratios.

There's also a major issue with DLP. Known as the rainbow effect, this issue causes brief red, blue or green trails behind moving objects in the scene. It's most obvious in high-contrast areas and is caused by the spinning colour wheel used within DLP projectors. The W7000 uses a 4x speed, six-segment wheel, which helps to minimise the effect, but we still clearly noticed it during the opening scenes of *The Dark Knight*. Heavy computer users and gamers tend to notice the rainbow effect more than ordinary folks, probably caused by spending too much time looking at screens. As a result, we recommend testing this projector before buying to see if you're prone to the problem.

If you're not part of the rainbow effect crew, the W7000 has some excellent qualities that set it ahead of similarly-priced LCD projectors. Pixel structure is basically invisible, even at stupidly close range, so it's perfect for pedantic gamers. On the flipside, this projector packs plenty of detail into the image, with razor-sharp edges. Colour reproduction is excellent for a DLP, as is the contrast ratio. It tends a little towards green in certain colour modes, but this can be tweaked using the wealth of options for calibration. There are even ISF settings hidden behind a password for perfectionists. Lens shift and a short-throw lens also allow for plenty of flexibility when it comes to mounting the projector. The W7000's brightness is likewise dazzling, making it suited to a medium-sized theatre room; however, it can be a tad too bright for small screens.

Its 3D performance is most impressive, especially considering this is BenQ's first outing into the stereoscopic zone. Where many 3D projectors struggle with cross-talk (aka ghosting), the W7000 beams out a solid image with hardly any shimmering auras. While the unit doesn't include any 3D glasses in the box, this is a DLP Link-compatible projector, so you don't necessarily need to buy BenQ's glasses. The extra brightness comes in handy when projecting in 3D, avoiding the dark images of the first generation of 3D projectors. This brightness could be why the lamp life is around half that of LCD projectors, coming in at just 2,000 hours.

If we weren't so sensitive to the rainbow effect, the W7000 would be a frontrunner for projectors in the mid-range price bracket. Thankfully, it's not a universal problem. Spend an hour or so testing it out in your local showroom – if you can't see anything for Kermit to sing about, you've got an excellent projector.

Bennett Ring

9/10

Wacom Intuos5 Touch

A graphics tablet no longer reserved for the graphics industry.

www.wacom.asia/intuos5 @
$265 small, $400 medium, $550 large, $45 wireless kit $
Wireless connectivity; heads-up display, multitouch gestures. ✔
Expensive, additional cost for wireless adapter. ✖

Chances are if you own a graphics tablet, you refer to it as a Wacom (pronounced wah-com) for the simple fact that, other than a couple of small players, Wacom basically dominates the market. That and the company's tablet technology is superb. Up until now, however, there was no great incentive to upgrade. If your current tablet that moonlights as a coaster still gives great stylus, why change?

While the primary role of the Intuos5 Touch is still ultra-accurate, stylus-based graphics work (which it delivers with 2,048 levels of pressure with an accuracy rating of 0.25mm), Wacom's latest also has a few new functionality perks up its sleeve. For the touchy-feely among us, the Intuos5 now offers fully customisable, multitouch gesture support. It's also no longer just for performing the requisite pans, zooms and rotations while you're Photoshopping cats for your latest Reddit post – it now works for general OS navigation as well.

Another welcome addition is the optional wireless functionality, though you'll need to shell out an extra $45 for the associated adapter plug. Suddenly the Intuos5 has gone from humble graphics tablet to a viable presentation/learning tool for offices and schools – basically a mouse replacement for anywhere computing happens.

The ExpressKeys and Touch Ring controls have also had a complete overhaul. Where there once sat controls seemingly engineered for clumsy inefficiency, there are now finely tuned instruments that provide users with not only haptic feedback, but a heads-up display mirroring every move, rotation and button press. And as with the multitouch gesturing, the built-in controls are fully customisable and ready for your operating system or application macros.

The Intuos5 Touch is available in three sizes (7in, 10in and 15in), but where tablets are concerned, we've *always* found that no matter what you do with it, bigger is most definitely better.

Troy Coleman

7/10

Plantronics GameCom 780

Rushing to remind us that a decent stereo headset is better.

www.plantronics.com/au @
$99 $
Rugged headset with an adequate sound for a reasonable price. ✔
Comfort limitations, no individual voice control, '7.1'. ✖

Sporting the ubiquitous über-robust, chiselled and squared appearance synonymous with the brand, the Plantronics USB GameCom 780 is a heavy-duty headset that can – and did – take a beating and come back for more. The USB cable is a generous 2m, but sheathed in an unyielding coating that won't allow it to straighten – a braided cord would have been better. There's a swivel point at the top of the cans for adjustment, but we can't say we were comfortable wearing them.

The left can is where all the action is and boasts a volume control and mic mute toggle within easy reach (so easy we accidentally cranked the volume every time we took the headset off), and a fold-out noise-cancelling boom mic. We'd have liked an individual volume control for voice for finetuning.

The closed headset boasts single 40mm speakers with a standard range of 20Hz-20KHz, with the '7.1' processing handled via Dolby Headphone and Pro Logic IIx technologies. We tested the 780's capabilities in four theatres of war; the Omaha landing scene from *Saving Private Ryan*; the lobby scene in *The Matrix*; FLAC-quality music spanning classical to death metal, and *Battlefield 3* on the gaming side. While they did an adequate job of delivering directional surround sound, we weren't blown away. That's more a problem with headset 7.1 technologies generally being a little 'meh' and the closed-can design. Faraway things don't sound far away, just quieter. At the price, the 780s aren't terrible value, but for our money we'd prefer to spend a little more and grab an excellent set of standard stereo headphones.

Troy Coleman

Axis M5014

7/10

Easy setup for video surveillance.

www.axis.com @
$669 $
Easy basic setup and use, good video quality. ✔
Poor documentation. ✖

With its new M5014 PTZ (pan, tilt, zoom) IP camera and accompanying Camera Companion software, Axis has made setting up a professional-grade indoor video surveillance system about as easy as it can get.

Apart from the need to run Ethernet cables, the actual physical installation is much like fitting a smoke alarm – once you've screwed the metal ring to the ceiling, you simply twist the camera onto the ring to lock it into place.

An alternative mount is provided for softer materials (such as some suspended ceilings) and there's an optional $35 wall bracket. As the camera uses Power over Ethernet, there's no need for a second cable or plug pack.

The software only requires minimal setup and discovers up to 16 Axis cameras on the network. Recordings are stored locally on a microSD card (Axis claims a 32GB card can store between two and four weeks of video, depending on the resolution and frame rate) or a network share – a small installation could use a PC for the purpose, but a NAS device is generally more convenient and less likely to be switched off by mistake. When the device fills, old recordings are overwritten.

The camera itself records 720p resolution at up to 30fps, so faces are clearly identifiable. The motion recording feature helps reduce the storage requirement and you can optionally record continuously at low resolution (with 720p recording when movement is detected) or limit recordings to a schedule (such as when the premises are unattended).

Although the M5014 includes a mic, the Camera Companion software doesn't currently support audio. Third-party Android and iOS apps also allow remote access, and the camera can be accessed via a web browser either locally or remotely (with an appropriately configured router).

Stephen Withers

Audiomate AM8112

8/10

Makes any headphones wireless on the cheap.

www.audiomate.com.au @
$60 $
Cheaper than a pair of wireless headphones, no digital compression noise. ✔
Transmitter shape can be unwieldy, some background hiss at high volumes. ✖

As much as we like the idea of wireless headphones (who *hasn't* dreamed of sneaking out in their jimjams for a midnight Xbox or movie session, only to be foiled by the danger of waking the other mammals in the house?), we have to admit they're a bit of an indulgence.

With the price of decent wireless sets starting at around $200 and quickly heading skywards, some big brands can command $700 or more for their premium kit. And while it might not be the prettiest bit of audio gear around, for those on a budget the AM8112 presents a tempting compromise: a low-priced wireless receiver and transmitter set that'll work with your existing headphones.

The AM8112 is exceptionally simple to use: the transmitter plugs into the playback device (TV/PC stereo) and the receiver into the headphones (via a 3.5mm jack and socket, respectively). Both dongles are powered by internal Lithium Ion batteries, which recharge via standard mini-B USB plugs and last around 4-5 hours before you'll need to charge them up again. We found we could roam about 10m before the signal cut out.

Acoustically, there was no digital compression noise (like with many Bluetooth or 2.4GHz wireless headphones), but we heard a small amount of background hiss when the receiver's volume was turned up. We found it was better to crank up the volume on the playback device. The transmitter's also a bit unwieldy and only just fit in the back of our test TV; you'll need a bit of space around your playback device's audio-out socket. That aside, these deliver exactly what's promised: acceptable wireless audio transmission at a nice price.

Dan Gardiner

7/10 Dell XPS 13 Ultrabook

Almost excellent...

www.dell.com.au @
$1,840 $
Impressively built, pleasant keyboard. ✔
Ordinary screen quality, flaky touchpad, gets overly warm. ✖

The V510192AU is a flawed gem. Dell claims its first ultrabook delivers great portability, snappy performance, solid build quality, excellent battery life and superb cooling. Well, three-and-a-half out of five's not bad.

With the glossy thin-bezel screen (1,366 x 768), it's smaller than 13.3in models, but the 1.36kg weight is run of the mill and the port variety is poor (USB 2.0, USB 3.0, Mini DisplayPort and headphone jack). However, we do like the row of LEDs next to the ports that show remaining power.

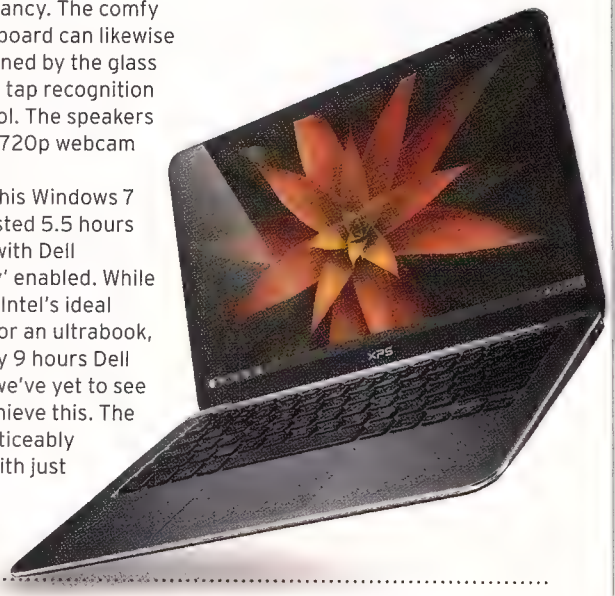
Snappy performance is provided by a low-voltage second-gen Intel Core i7-2637M, 4GB of DDR3-1333 RAM and a 256GB SSD. In PCMark 7, these punch out a high 3,808.

The build quality is superb: the carbon fibre underside, Gorilla Glass screen, aluminium screen backing and plastic-coated magnesium keyboard deck all make for a premium feel. However, the screen hinge doesn't swing back quite far enough for comfortable lap usage and the display has unimpressive viewing angles, but decent colour vibrancy. The comfy backlit chiclet keyboard can likewise be a little undermined by the glass touchpad's erratic tap recognition and gesture control. The speakers were soft, but the 720p webcam was of fair quality.

Battery life in this Windows 7 Ultimate model lasted 5.5 hours on 'Power Saver' with Dell 'Intelligent Display' enabled. While that's higher than Intel's ideal 5-hour minimum for an ultrabook, it wasn't the nearly 9 hours Dell claims; to be fair, we've yet to see any ultrabooks achieve this. The XPS 13 also got noticeably warm on our lap with just light usage.

On the whole, while the XPS 13 is a fine effort, a few quirks undermine an otherwise stellar product. We'd still opt for an ASUS Zenbook or Toshiba Z830 first.

Conrad Bem



8/10 Samsung Series 5 Ultra

Can an ultrabook be an all-rounder?

www.samsung.com/au @
$1,499 $
Strong versatility, good portability. ✔
Ordinary screen, so-so battery life. ✖

The 530U4B-S01AU is Samsung's first attempt at an ultrabook/all-rounder hybrid; unlike most of the former, it has both a dedicated graphics card and a DVD burner. According to Samsung's marketing spiel, it's meant to offer 'exceptional performance in a portable and premium form', and by those metrics it does largely succeed.

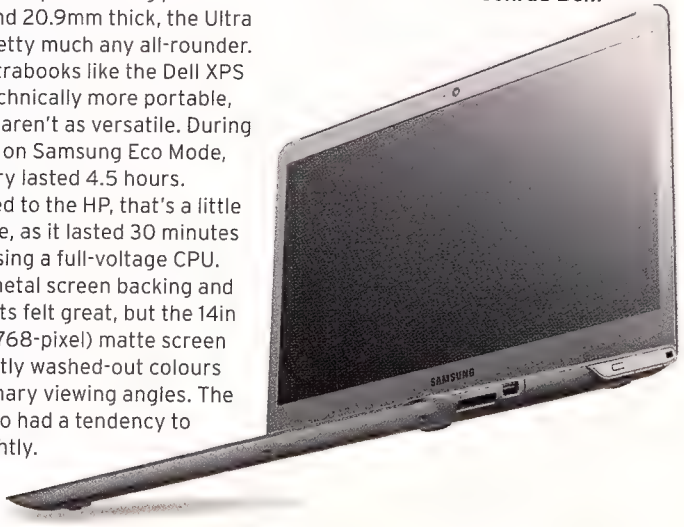
Exceptional performance was secured by the AMD Radeon HD 7550M dedicated graphics card. Testing with 3DMark Vantage on Performance, the Graphics score was 2,268, as compared to 1,217 for the usual integrated Intel HD Graphics 3000. Together with a low-voltage second-gen Intel Core i5-2467M processor, 4GB (1,333MHz) of memory and a 500GB 5,400rpm hard drive plus a 16GB SSD cache, it scored 2,274 in PCMark 7. That's comparable to HP's Pavilion dm4-3011tx ultraportable, but the Samsung is a good 10% lighter. The physical connectivity is also good, with Gigabit Ethernet, HDMI, three USB ports (two of which are 3.0) and an SD card reader.

Portability is a strong point: at 1.79kg and 20.9mm thick, the Ultra beats pretty much any all-rounder. Other ultrabooks like the Dell XPS 13 are technically more portable, but they aren't as versatile. During light use on Samsung Eco Mode, its battery lasted 4.5 hours. Compared to the HP, that's a little lacklustre, as it lasted 30 minutes longer using a full-voltage CPU.

The metal screen backing and palm-rests felt great, but the 14in (1,366 x 768-pixel) matte screen had slightly washed-out colours and ordinary viewing angles. The hinge also had a tendency to stick slightly.

While loud, speaker quality was ordinary, as was the webcam's recording quality at 720p. While the battery life and build quality could be better, overall the 530U4B-S01AU is a commendable effort.

Conrad Bem



6/10 Canon Pixma MX376

A lot for little money, but is it enough?

www.canon.com.au @
$75 $
A budget model that gives decent results. ✔
USB only, but no USB cable. ✖

Given the low price, it's hard to complain that the MX376 is USB only, but smartphone or tablet owners should consider a Wi-Fi model. There's only one paper tray, no CD printing, no memory card or USB storage support, and duplex printing is a manual operation. You get print, scan, copy and fax.

The MX376 uses two cartridges (black and colour) with built-in print heads. That's a more expensive arrangement than simple ink tanks, but it helps maintain top quality and avoids the shock of buying a new print head if the old one becomes clogged. Canon touts the front loading of paper and cartridges, but we found it more awkward to install the cartridges here than with models where access is gained by raising the scanner bed, especially as they don't simply click into place.

Setup and software installation are otherwise straightforward. One minor niggle is that the installer recommends a head alignment after setup, but doesn't start the process for you or even provide instructions, instead just referring you to the help files.

Canon's usual software is provided, with a convenient front-end menu and Easy-PhotoPrint EX for producing a variety of print projects such as calendars.

The first page of our business document printed in 42 seconds, with the second dropping after another 35 seconds that included a significant and reproducible pause. Text quality matched that of other recently tested models that cost up to five times as much, although the MX376 showed some loss of shadow detail in graphics. Colour copying took 40 seconds and the results were merely acceptable, with noticeable banding, over-bright greens and subdued browns.

The MX376 handles borderless photo printing from 10 x 15cm to A4. Our usual test image printed in a respectable 62 seconds (10 x 15cm). The results were generally good, though flesh tones were more orangey than we'd expect – the *Jersey Shore* look, perhaps? (In case you're wondering, we do use a multi-ethnic test photo.)

Stephen Withers

7/10 OKI C831

Speedy, shiny A3 colour

www.oki.com.au @
$2,860 $
Speedy, sharp text, bright colours. ✔
Excessive glossiness, some features require extra cost options. ✖

You couldn't call the C831 svelte, but OKI has done a good job of packing an A3 colour LED (laser-like) printer into a relatively compact case.

Installation is unremarkable except that the duplexer isn't factory installed, so you need to prise off a back panel and slide it in. PostScript emulation and XPS drivers are provided in addition to the PCL driver we tested. The package includes a small range of utilities, notably PDF Print Direct, which can print .PDF files without opening them in Adobe Reader or similar. Additional software (including Template Manager to incorporate static content such as logos and forms, and Print Job Accounting) is available for download.

The first page of our business document dropped in 14 seconds, followed 2 seconds later by the second, consistent with the 35ppm claim. Duplex printing took an extra 5 seconds. A message displayed by the installer said the printer would default to duplex printing, but that wasn't the case. Text and business graphics were rendered to a high standard, and while the toner is applied very smoothly across the printable area, it was a bit glossy.

When our document was enlarged to A3 it took just slightly longer to print at 18 seconds. When you load different-sized paper, you need to remember to change the size dial on front of the tray, but it's a lot easier than having to mess around with the printer's menus.

If you're looking for economy, the C831 has a 'toner save' mode that basically lightens everything with the optional exception of anything that's 100% black (i.e. ordinary text), and when in deep sleep mode, power consumption is just 1W.

Some of the features require optional hardware. For example, secure print, which holds the job at the printer until it's released by entering a PIN, and overlays both need the SD card option.

Stephen Withers

best apps
LATEST SOFTWARE

Google Play

There's an app for pretty much anything you want to do. Here we take a look at our favourite Android ones.

Apex Launcher

Alternative launcher for ICS users.

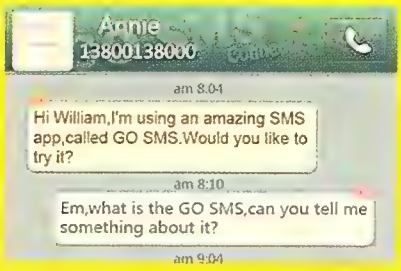
Free/$3.89 Pro > Android Does > tinyurl.com/6nkgz6p

Ice Cream Sandwich ships with what I think is the best version of the Android launcher so far (as you'd hope), so it can be quite upsetting when your phone manufacturer decides that its modified version is better (*cough* TouchWiz *cough*). Of course, it's child's play to replace the launcher, but when I upgraded my Galaxy S II to ICS, my previous launcher of choice – LauncherPro – no longer cut the mustard when compared to what the native ICS users had. Further to this, it was difficult to track down an installable stock ICS launcher. Thankfully, I found Apex Launcher. Apex Launcher emulates that gorgeous, simple, stock ICS feel, but adds the customisability and extra features I'd come to love and rely on, as well as a few new ones that will only further my dependency on custom launchers. Namely, it supports the following: a customisable home screen grid size and up to nine home screens; scrollable dock with up to seven icons per page and up to five pages; infinite and elastic scrolling on the home screens, drawer and dock; transition effects between home screens; customisable icons and labels for shortcuts and folders; multiple drawer styles and sorting; home screen gestures and more. For $3.89, you can upgrade to the Pro version, which brings with it even more options for you to try.

Offers the ICS feel with extras and customisability.

GO SMS Pro

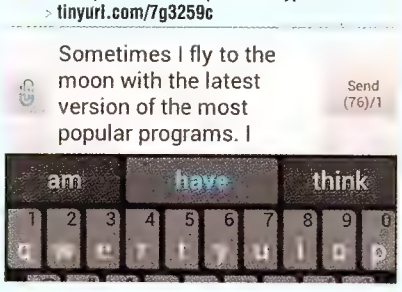
Free > GO Dev Team > tinyurl.com/87mtobh


Annie
13800138000
am 8:04
Hi William,I'm using an amazing SMS app,called GO SMS.Would you like to try it?
am 8:10
Em,what is the GO SMS,can you tell me something about it?
am 9:04

I used to be a Handcent devotee. That app had been with me since the days of Cupcake, but software moves on. What made me switch? GO SMS Pro provides a cornucopia of themes – some paid, some free. Beyond this superficial reason, it also supports scheduled SMS, pop-ups, file sharing, non-SMS chat, PIN access, blacklisting, emoji and more. Best of all, there are three running modes to make the app as heavy or light as you like.

SwiftKey X

$2.99 (Trial available) > TouchType Ltd > tinyurl.com/7g3259c



My keyboard of choice on Android is SwiftKey X because aside from its good looks, it has creepily magical predictive text. When you install SwiftKey X, it asks you to let it search across your SMS, email and social networks to fill its dictionary with your preferred lingo and analyse relationships between words, so when you type one word (such as 'poop'), it will suggest a likely proceeding word (such as 'deck').

Colour Splash FX

99c (introductory) > androidslide tinyurl.com/6o5pbd2

Colour Splash FX allows you to create black and white images containing coloured objects. You can import any photo and with an adjustable brush, paint over the picture in natural colour. It isn't the first app of its kind, but it's a good-looking effect; indeed, *Schindler's List* wouldn't have been the same without it. At the time of writing, the app was still under heavy development and images are only output at 640 x 480.

App Store

We've scoured the App Store and reviewed the best apps available for your iDevice.

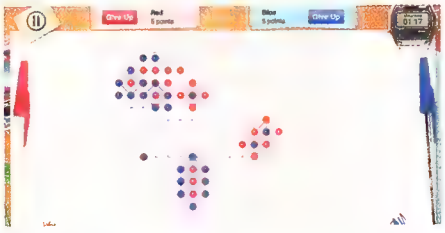
Flight Control Rocket

99c > Electronic Arts > tinyurl.com/773a4xn

Flight Control Rocket is the follow-up game to Flight Control, but with a few new features that set it apart. As in the original, the object is to direct the many onscreen ships to their respective colour-coded landing pads while avoiding collisions. It adds the 'rescue' game mode, where you have to pick up stranded, colour-coded astronauts, as well as 10 new motherships and four new bots (read: bonuses). With cute '60s-themed graphics and music, and enjoyable, challenging gameplay, it's worth the trip.

Tochki Online

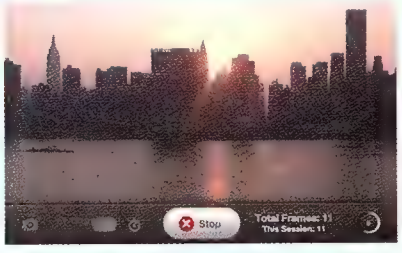
Free (Ad-supported) > Manera > tinyurl.com/7emzu3o



Sometimes I have a nostalgic pang for the old high school days I spent up the back of my maths class, drawing doodles or playing games on grid paper. I'm not about to try and recreate that experience in real life, however – I'm sure Ms Crabtree won't appreciate the 20-something year old giggling up the back of her classroom – so I was quite happy to find the classic 'surround your opponent's dots with your dots' schoolbook game: Tochki. It's simple to learn, with adorable 'real-world' graphics and there's no need to dig out your old schoolbooks to play.

Frameographer

$2.99 > Studio Neat > tinyurl.com/d5ytt27



I love stop-motion/time-lapse videos, but if you've ever tried doing it yourself, it quickly becomes obvious that it's very tedious work. Boom! Frameographer makes it easier. Since stop-motion takes so freaking long to do, Frameographer is designed to allow you to come back to your sessions, picking up at the frame you left off. It also makes reviewing frames a snap – deleting the erroneous ones – and allows you to choose the desired frame rate before you export it as a movie.

Bumpy Road

It's an arcade-based love story.

$2.99 > Simogo > tinyurl.com/7atopj4

Don't let the tagline above deceive you, this is a really fun game. It has that perfect blend of interesting graphics, cute story, and perhaps most importantly, innovative gameplay. The premise is that you and your love have decided to go for a drive. The car is perpetually propelled eastward, but rather than controlling the car, you control the ground it drives upon. By touching the ground you raise it, causing the physics-based car to bounce off of the road or speed up/slow down, allowing it to avoid pitfalls and collect bonuses (for points). There are two game modes available: Evergreen Ride, where you drive through a neverending, dynamically generated landscape collecting memories (naw) until you either run out of fuel or fall into a water-filled pit. The gizmos littered in your path provide you with fuel, and if you collect enough, they'll trigger a pit-free turbo mode. The other mode, Sunday Trip, is also dynamically generated, but comes with a finish line that you must reach as fast as possible. There are no pitfalls, so just try and collect as many bonuses as you can to speed up your car or reduce your time. It's the complete experience of Bumpy Road that really makes it memorable and certainly one of the standout apps on iOS.

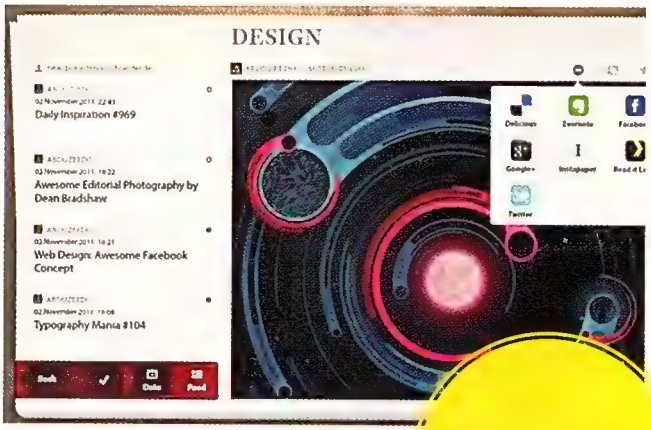
App World

BlackBerry's App World is growing by the day and has a surprisingly wide range of apps, consumer as well as business.

Newspile

Gorgeous Google Reader client for PlayBook.

US$2.99 > Dennis Schneider > tinyurl.com/6wmk222



The mother of all RSS readers on BlackBerry.

One of the most compelling uses for tablets, and indeed the PlayBook, is their ability to replace newspapers, magazines and books. The thought of holding in your hand potentially every book ever published still makes me smile and even feels a touch magical. In short, I take my reading apps seriously. A core requirement in my 'axis of information' is a good news/RSS reader app (as an aside, the other two are a good ebook reader and a good social network client), so I was quite pleased when I found Newspile. Newspile connects to your Google Reader account, drawing in your favourite feeds and displaying them in a newspaper-like way. It supports two-way syncing with Google Reader, meaning your unread articles and starred items will appear on your PlayBook and also sync back to Google Reader. What I like most about it – and what really sets it apart from most other reader apps – is the gorgeous user interface; I really like the newspaper feel, which carries through to the attractive typeface. More than just the superficial, the UI also allows gesture-based refreshes, inline videos, the ability to jump out to the browser to view the stories, offline cache of articles and sharing via deli.cio.us, Evernote, email, Facebook, Google+, Instapaper, Pocket (Read it Later) and Twitter.

Super Ninja Skydiving Plus Zombies

US$0.99 > Matthias Bedard > tinyurl.com/6mwr4z9

How can you possibly pass up on this PlayBook game, given the title? You're a freefalling, sword-wielding ninja, hellbent on slashing skybound zombies as you can, while you collect bread and make your way to whatever destiny awaits you once you reach the end. You'll also need to avoid the overweight exploding man. Great graphics, smooth gameplay, enjoyable sounds, increasing difficulty, and all the gore you could ever want, combine to make this a standout app.

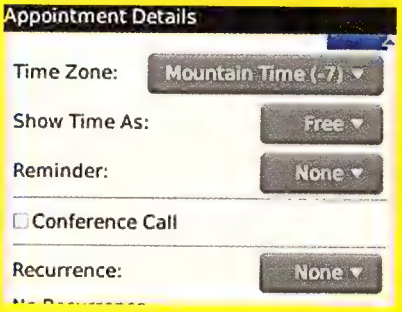
Facebook Contact Sync

US$3.99 > VirtuosITy Solutions > tinyurl.com/74r3k3m/

Facebook Contact Sync is the best and easiest way I've seen to get all of my Facebook buddys' contact info onto my BlackBerry handset. It's really as simple as installing it and hitting go. It then whisks off to Facebook and downloads all of your friends' available names, pictures, phone numbers and more (depending on their privacy settings) in one go, saving you from having to do them one by one. I noticed that I had to reboot my handset for them to appear, though, so keep that in mind.

myCallLog

US$2.99 > Toysoft Development Inc > tinyurl.com/crbn3nj



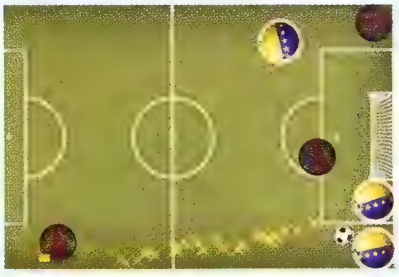
myCallLog moves your call logs to your calendar so you can view them in the context of your professional (or personal) life. This can be handy when you have to claim certain calls back for work, or just want to know exactly when you last called your mother (you bad kid, you). Additionally, you can save a note to the calendar or contacts app after the call ends, which makes it a very handy time- and context-based notation app, too.

Apps Marketplace

Windows Phone 7 Marketplace has more and more great apps available.

Air Soccer Fever

Free > Dangling Concepts > tinyurl.com/7kxcn6z



A blend between air hockey and soccer, Air Soccer Fever stands apart from the many air hockey clones by throwing in a few soccer elements (three flickable pucks, yellow and red cards for fouls, and annoying chants from the audience), and most importantly, local and internet multiplayer, plus cross-platform Windows 8 support (when it arrives). My biggest gripe was that the internet multiplayer seemed to suffer from some serious lag, but overall the game is really quite addictive and well worth look.

Grow

$2.49 > Epic Pixel > tinyurl.com/7s49moo

As a wee baby fish trapped in a jar, your only real desire is to grow up to be one of the big fish that you've read about in your waterproof story books. To achieve this, you tell yourself, that you need to eat as much as you can. So you start chomping. And growing. And then chomping some more. Adventures abound as you progress beyond your fish tank, where food, coins and danger await you across 78 levels and two game modes.

Turbo Camera

$1.99 > venetasoft > tinyurl.com/cswoh6v

Sometimes it can be difficult to catch that perfect action shot, like that special moment when your cat 'finds' the spring-loaded mouse at the bottom of its food bowl. Timing is critical and a wealth of great gags have fallen short of Twitter fame because of a lack of photos to document them. So, if you're keen for internet fame, you should try Turbo Camera, as it shoots at around 14-16 shots per second (albeit at 640 x 480), almost guaranteeing you to capture that perfect moment.

Fantasia Painter

A seriously comprehensive photo editing app.

$2.49 (Ad-supported version available) > Nokola > tinyurl.com/6t3ax7v

Phone photography is becoming better and better as time moves on. Only a few short years ago it would have been nigh on inconceivable for me to use my phone as my primary camera, yet there's now a noticeable layer of dust accumulating on my point-and-shoot. The low-aperture lenses of phones are greatly outweighed by the benefit of instant editing and sharing of images. Indeed, Fantasia Painter provides one more nail in the pocket camera coffin. As the name implies, Fantasia Painter is more than just a photo editing app; while you can do the usual editing, such as colour, brightness, contrast, white balance, and so on, the app also allows you to paint colour and effects onto your images, or even a blank canvas. There really are a massive number of tools, filters and effects available in the app, so it can be a little intimidating when you start using it. Thankfully, the app opens with a decent how-to guide to get you started, but you won't get the full power of the app until you start experimenting. Notably, the biggest flaw of the app is actually a flaw in the platform: when you have such powerful editing tools on hand, you really want to be doing the edits on a bigger screen.

WHAT'S INSIDE YOUR PC?

Mike Bedford reveals the secrets of the weird and wonderful materials that are hidden away deep inside your computer.

Call us sceptical, but we bet you didn't know 7,7,8,8-tetracyanoquinodimethane is contained within your PC. It's not nearly as well-known as silicon, but today's motherboards wouldn't be nearly as reliable without it. This is just the tip of the iceberg – PCs are built from a range of obscure materials, many of which are extremely expensive and difficult to mine or extract. Chances are you wouldn't be able to describe the properties of neodymium, ruthenium or gallium, but they all have a vital part to play in keeping your PC running smoothly.

Here we take a whistlestop tour of the PC, component by component, delving into the amazing substances used in its manufacture. We'll see something of their unique properties and why they're used, but we'll also investigate the materials themselves to see what they look like and where they come from. We'll ponder what will happen when supplies of the rarer elements run dry, investigate whether these chemicals pose a health risk, and reveal little-known and fascinating facts about these most mysterious of materials. Of course, having these facts at your fingertips won't make you any more effective at improving your PC's performance or choosing your next upgrade, but you'll be off to a flying start when you're next asked in a pub quiz what links tantalum and niobium.

SILICON CHIPS

So, silicon chips – and here we could include the processor, memory, GPU and the Southbridge chip – are made of silicon, right? Well silicon is vitally important, but no chip made entirely from silicon would stand a chance of working.

To look at a piece of silicon you'd think it was a metal, but if you were to drop it the chances are it would shatter, which isn't what you'd expect from a metal. With properties intermediate between metals and non-metals, silicon is part of a small group of chemical elements known as metalloids or semi-metals. Semi-metallic is also how you'd describe silicon's electrical properties – it will conduct electricity, but not very well.

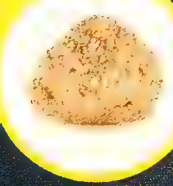
However, by doping silicon (the technical term for adding a small amount of another element), its conductivity can be vastly improved. This is the key to the operation of the transistor, the basic building block of all electronic circuits. To cut a long story short, doping with boron or arsenic turns the silicon into something called a p-type semiconductor; doping with phosphorous or gallium creates an n-type semiconductor. The reasons for this are too complex to explain here, but by combining n-type and p-type semiconductor materials you end up with a transistor, and by connecting enough of them together you can create a processor.

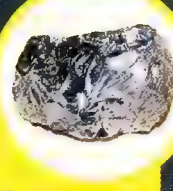
The transistors are connected using thin copper strips. A complicated chip will need several layers of copper tracks, so layers of insulating material must be used in between to prevent them shorting out. The insulator is silicon dioxide – the same compound that makes up pure white sand. This can be produced easily by oxidising the surface of the silicon wafer as the chips are being manufactured.

The exotic mix of chemicals in a processor doesn't end here. Intel and IBM made the headlines a few years ago when they began using an element called hafnium to improve the performance of their chips. If you've not heard of this obscure element before, you're in good company. Suffice to say, it's a metal

GOLD

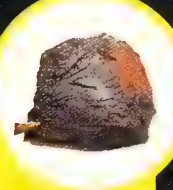
Standard 1kg gold ingots would set you back over $50,000 each. The contacts on the processor, memory modules and expansion cards are all plated with gold to prevent oxidation, which would lead to poor electrical contact.





SILICON

Although it looks like a metal, silicon is one of seven elements called metalloids. Adding trace amounts of nearby elements in the periodic table turns silicon into an n-type or p-type semiconductor material, from which the transistors in chips are made.



TANTALUM

Tantalite is the prime source of tantalum, but experts reckon that stockpiles could run out in as little as three years' time. Given that some types of capacitors on motherboards are reliant on this metallic element, this would be a worrying development.

ARSENIC

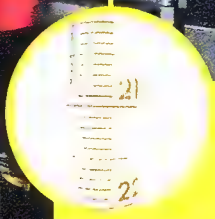
It seems hard to believe that the metalloid arsenic can be extracted from realgar, the mineral shown here. Equally surprising is the fact that this poisonous element is found in processors. It's only present in minute amounts, however.

RUTHENIUM

Despite looking the same as most other metals, ruthenium is rarer than platinum and has some unique magnetic properties required by today's hard disks. Fortunately, this expensive element is used on the platter in layers just four atoms thick.

PHOSPHOROUS

This is a non-metal and is so reactive it has to be stored underwater to keep it from bursting into flames upon contact with air. Alloyed with nickel, phosphorous is stable and is used to coat the platter in a hard disk before the magnetic layers are added.



EPICHLOROHYDRIN

It's a colourless liquid — and a smelly one at that — but when it's mixed with bisphenol-A, epichlorohydrin reacts to produce the epoxy resin that bonds the motherboard together. The polymer is a good insulator and flame-retardant.

COPPER

Copper is a good electrical conductor and is cheap, so it's used for interconnections in the processor, on the motherboard and in cables. It can be found as native copper, shown here, although the common ore is the chemical compound copper iron sulphide, chalcopyrite.

It might not be as spectacular as its use on the Apollo Lunar Module, but the element hafnium is used to great effect in today's high-performance processors.
We've all heard of silicon chips, but manufacturing a processor involves a lot more materials than the name actually implies.

and its close neighbours in the periodic table are the equally rare elements lutetium, tantalum and the radioactive material rutherfordium. If you hanker after little-known facts, it's named after Hafnia, which is the Latin name for the Danish capital, Copenhagen, where it was discovered in 1923. Worryingly, because of its use in the control rods of nuclear reactors, some experts have suggested that it will run out within 10 years at current rates of consumption. That's a long time in the world of semiconductors, though, and we feel confident that an alternative – perhaps zirconium – will step up to the mark.

While the apparent scarcity of hafnium might suggest that it would be expensive, there's another element found in many processors that costs about 50 times more, gram for gram. Gold is only used in very small quantities, but it's used as the plating on the pins or pads of most high-performance processors. The property that makes it such a good material for jewellery also makes it an excellent metal for plating components: as a fairly unreactive element, it doesn't tarnish due to reaction with air. This doesn't just affect its appearance, it means the good electrical contact between the processor and its socket won't diminish over time.

If you consider yourself safety-conscious, you may have raised your eyebrows at the mention of one particular element used in semiconductor manufacturing. When the Cornish tin mining industry was in full swing 150 years ago, that element was a byproduct of tin production and was sold to America as a pesticide in the fight against the boll weevil beetle that was devastating the country's cotton crops. The element in question is arsenic, a minor constituent of the tin ore cassiterite, which was driven off by heat treatment in a calciner and condensed in a chamber called a labyrinth. Given the fact that the young boys who were employed to remove the arsenic from the labyrinth rarely lived beyond their early 20s, you'd be excused for questioning how sensible it is to put it in PCs. You'll be relieved to hear that only small portions of a silicon chip are doped and even then, concentrations measured in a few parts per million are all that's needed to provide those all-important semiconductor properties. The bottom line is that integrated circuits contain no more than trace amounts of arsenic.

HARD DISK PLATTERS

We all know that hard disks store data magnetically, but there are few similarities between them and the old DAT format used in the 1980s. Both use a head to read and write data to magnetic media, but there the similarity ends. Magnetic disks use a much more efficient form of recording than is possible with a flexible tape, although that efficiency comes at a price.

While magnetic tape is a simple, cheap strip of plastic film impregnated with iron oxide (rust), or more recently chromium dioxide, the platter of a hard disk drive is manufactured in a much more expensive multistage process that demands an extremely high degree of accuracy, and uses some interesting and esoteric materials.

The starting point is a plain disk, machined to high tolerances from a non-magnetic material. This way the magnetic properties can be accurately finetuned by adding thin layers of other materials. The disk is typically made from either glass or metal. Aluminium is a good choice since it's light and non-magnetic, but hard disks need to be robust and aluminium isn't hard enough by itself. Instead, the material used is an alloy of aluminium and magnesium, plus small amounts of other elements like silicon, copper and zinc. There are therefore five or more substances in the blank platter, although none of them are rare or unusual – the more esoteric materials are used later.

The platter will spin at up to 7,200rpm and the read/write head will hover millionths of a millimetre above it, so any unevenness would be catastrophic – the head would crash immediately. It isn't possible to polish aluminium alloy to the correct smoothness, so the blank must be coated in a layer of a substance called NiP, which can take the high polish. This material is an alloy of nickel and phosphorous. An alloy is usually thought of as a mixture of substances that share their properties, but NiP couldn't be more different from its constituent parts. Phosphorous is a non-metallic element and a very reactive one at that. In its white elemental form, it will ignite spontaneously in air and burn fiercely. It's also highly toxic

and glows in the dark. However, like nickel, NiP has all the properties of a metal and is relatively inert. Strangely, though, whereas nickel is magnetic, NiP isn't.

Most of the other materials on the platter are responsible for its magnetic properties. Iron is the most familiar magnetic material, but those you find in a hard disk are far more interesting. There are many magnetic (or ferromagnetic, to be more accurate) metals, but those used in a hard drive are chosen for the ways they interact. Since a more detailed explanation would take us into the intricacies of physics, we'll stay well clear of the 'why' and concentrate squarely on the 'what'.

First, there's something called the soft magnetic underlayer, which is made from an alloy of cobalt, nickel and iron. In the highest-performance disks, the soft magnetic underlayer is divided in two by a thin layer of the element ruthenium. Only a very small amount is needed, which is just as well – as the 74th most abundant element on Earth (and there are only 90 naturally occurring elements), ruthenium is rarer than gold and platinum. Accounting for one part per billion of the Earth's crust, just 12 tonnes are produced annually, which is only enough to make a 1m cube. Its name comes from Ruthenia, the 13th century Latin word for the ancient land of Rus, which comprised parts of current-day Russia, Belarus, Ukraine, Slovakia and Poland.

The true recording layer is where we find the really expensive materials, as we're now looking at an alloy of cobalt, chromium and platinum. Although platinum is more abundant than ruthenium, because it has so many more uses – mostly as a catalyst in the chemical industry and catalytic converters in cars – it's much more expensive.

HARD DISK HEADS

Rare and expensive elements aren't only found on the platter, as we'll see when we look at that other important part of a hard disk drive: the read/write head. The head is attached to an arm assembly, which can move to access any of the concentric tracks of data on the platter. An integral part of the arm is a wire coil that moves in a magnetic field whenever an electrical current is applied. That magnetic field is provided by a very powerful magnet, of which a major constituent is neodymium. Neodymium looks much the same as any other metal, but it's unique in being the most magnetic of all the elements. In its raw form that property isn't particularly useful, since neodymium has such a low curie point – the temperature above which magnetism is lost – that anything containing a neodymium magnet would have to be refrigerated.

This is where those other metals come in. By mixing two parts of neodymium with 14 parts iron and one part boron, a combination of strong magnetism and a high curie point is achieved. And we really are talking about strong magnets – a neodymium iron boron magnet can lift over a thousand times its own weight. This gives rise to safety concerns – if you ever try dismantling an old hard drive, make sure your fingers are well out of the way if the pair of neodymium magnets find themselves drawn together. That's not all, while neodymium, iron and boron are all malleable, the alloy used in magnets is brittle, so if you do allow a pair of neodymium magnets to snap together from any distance, watch out for flying shards of alloy.

THE MOTHERBOARD

To the engineer, the motherboard might seem like the poor relation to the processor and the hard disk, but while the complexity

THE PERIODIC TABLE

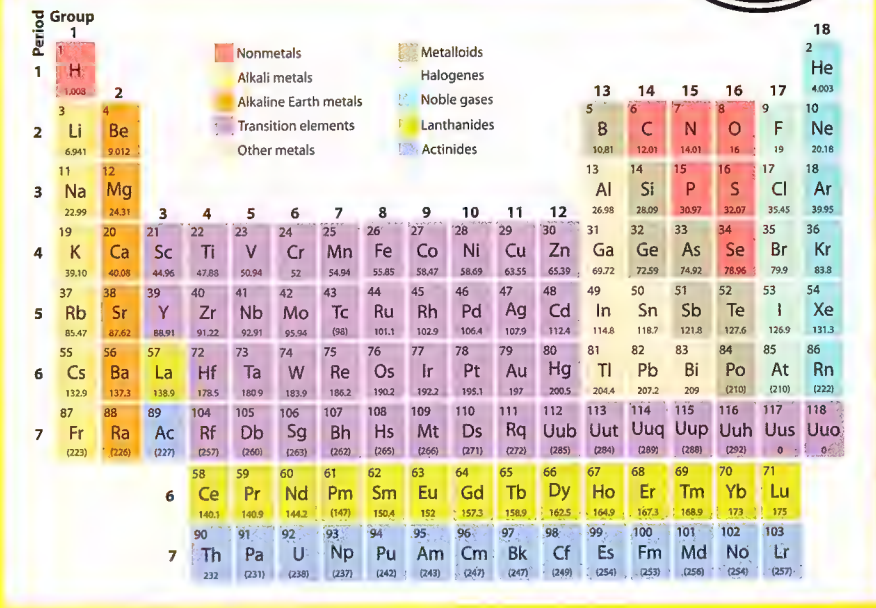
The arrangement of the periodic table tells us a great deal about the elements used in our PCs. The table is arranged so that each element's atomic number (the number of protons, and therefore neutrons, in the nucleus) increases as you move from left to right. Each row in the table is called a period and represents an energy level. The number of electrons in each energy level is displayed on the table. For example, hydrogen and helium are on the first period, so the first energy level can have a total of two electrons. The second level can have eight electrons, the third 18, the fourth 32 and so on.

Elements with similar properties are arranged into groups, from the noble gases (these are colourless, odourless and have very low reactivity) to the alkali metals (these are silver-coloured, soft and extremely reactive). From its position on the table, we can see silicon (Si) has an atomic number of 14, is in period 3 (it has 14 electrons) and is a metalloid. It's less reactive than carbon (C), but more reactive than germanium (Ge).

This arrangement meant elements could be predicted before they were discovered and in many cases, when they were found, their properties were exactly as anticipated. For instance, francium (element 87), which was discovered in 1939, has never actually been seen because it's highly reactive and short lived.

The lanthanides and actinides (rare earth metals) are usually shown as two rows below the main table. This is done to make the table fit on a page more easily.

The periodic table tells us a lot about the properties of chemical elements.



of its manufacture might not compare, the substances used are no less intriguing. The printed circuit board (PCB) is a sheet of material with conducting copper tracks printed onto both sides and sandwiched in several intermediate layers. The tracks make the connections between the components and the sheet onto which they're printed provides mechanical strength while insulating between the connection layers.

Copper is far more common than the likes of ruthenium and neodymium. It's been used for millennia, is 10,000 times more abundant than platinum and thousands of times cheaper. It's one of the most important materials in a PC and you'll also find it in the various cables that connect components like the hard disk and the CD/DVD drive to the motherboard.

The property of copper that makes it so important to electronics is its conductivity. Although it's not the most conductive material, if it was pensioned off in favour of silver (the only metal more conductive), the cost of electronics would soar.

Perhaps the most astonishing thing about copper is the vast scale of its production. From its discovery in the fourth century BC in tiny mines on the island of Cyprus (where copper gets its name), copper ore is now extracted from huge open-cast pits. Bingham Canyon Mine near Salt Lake City in Utah, currently the world's biggest producer of copper, is 1.2km deep and 4km wide, covering an area of 1,900 acres. The annual production of 300,000 tonnes of copper is brought to the surface in trucks standing 7m tall and weighing more than a jumbo jet.

The other element of a PCB, the insulating sheet, might seem simple, but appearances can be deceptive. The PCBs used in today's motherboards have to provide the ideal combination of electrical, thermal and mechanical properties. They also have to meet safety requirements so that if a component fails and overheats, the board won't catch fire and emit toxic fumes. The most common insulating material today is FR-4, which comprises sheets of woven fibreglass bonded by flame-retardant epoxy resin. Many manufacturers use a similar material for simple car body repairs, but its function in PCBs is much more complex.

Here we get into the murky world of organic chemistry. The two compounds that form epoxy resin are chloromethyloxirane (otherwise known as epichlorohydrin), and 4,4-(propane-2,2-diyl)diphenol (otherwise known as bisphenol-A). The former has the chemical formula C_3H_5ClO, and the latter is $C_{15}H_{16}O_2$, but this isn't particularly helpful since in organic chemistry two substances can share the same chemical formula and differ in their structure.

We won't get embroiled in molecular diagrams. All we need to know is that when these two liquids are mixed, a polymerisation reaction takes place that results in a much larger molecule, which forms a solid. This in turn bonds the fibreglass sheets and fills the holes in the weave to produce a tough, insulating flame-retardant sheet to which copper foil can be applied.

RESISTORS

If you take a look at a motherboard, you'll see lots of small components that look like tiny black blocks and metallic cylinders. Most of these will be either resistors or capacitors, which electronics engineers call passive components. We can't fully explain the functions of each one here (for a guide to basic electrical components, visit **tinyurl.com/cjtmbeb**), but as with most parts of a PC, delving inside the passive components brings to light yet more unusual substances.

Resistors do what the word suggests – they resist the flow of an electrical current. They differ in their resistance (measured in ohms, a unit of how much they impede the flow of electricity) and their power rating (how much power they can dissipate by resisting that current without burning out).

Early resistors were little more than a cylinder of carbon, but those days are long gone, and even in this most basic of all components we can now find quite a mix of elements. The major part of a resistor is a ceramic block, typically made of aluminium oxide (alumina), which gives the finished component enough bulk to be handled and soldered. This material is used because it's a near-perfect insulator.

The electrical path is made by depositing a film of ruthenium oxide. Unlike most metal oxides, this material has limited electrical conductivity, which is exactly what's needed. To cap it all off, metal electrodes made from an alloy of platinum, palladium and silver are attached at each end.

Palladium, like ruthenium, rhodium, osmium, iridium and platinum, is referred to as a platinum group metal. These elements are grouped together in the periodic table, and they're found together geographically – most notably in the Bushveld complex of South Africa – and they all command a high price. Since they're often found together in the same ores, platinum group metals have to be separated before use. This is difficult due to their similar properties and requires an expensive multistage chemical process you can read about at **tinyurl.com/2vakwt**.

CAPACITORS

Capacitors allow an AC current to pass while blocking a DC current. At their simplest, they're formed from two sheets of metal separated by an insulator, called the

BEYOND THE DESKTOP

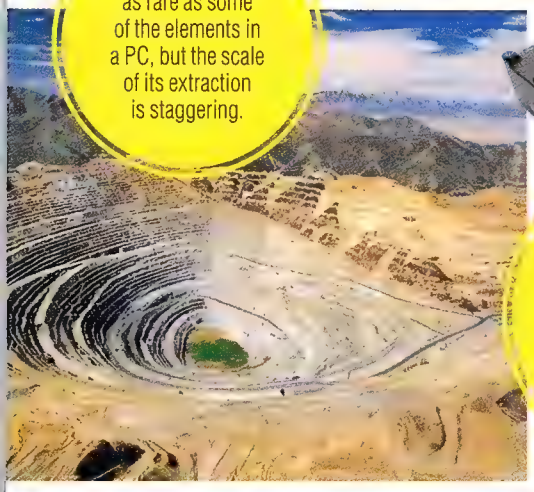
Our mobile devices contain some precious materials.

Mobile devices like tablets, cameras and smartphones contain rare and expensive materials that you won't come across in an average desktop PC. One of these is xenon gas, which you'll find in the vertical column at the very right-hand side of the periodic table (see page 73). The elements in this group are called the noble gases and are pretty much unreactive chemically.

Noble gases are non-conductive for the most part, but will allow a current to pass through if the voltage is high enough, and that's what makes xenon so important. When this noble gas is persuaded to conduct, it emits a very bright pulse of almost pure white light. This makes it perfect for the flash tube of your smartphone or digital camera.

Another interesting material you'll find in mobile devices is iridium, or indium tin oxide. This compound is unusual in being both transparent and conductive — essential properties for a touchscreen. Sadly, indium is another element that's running out and researchers have yet to find a viable alternative.

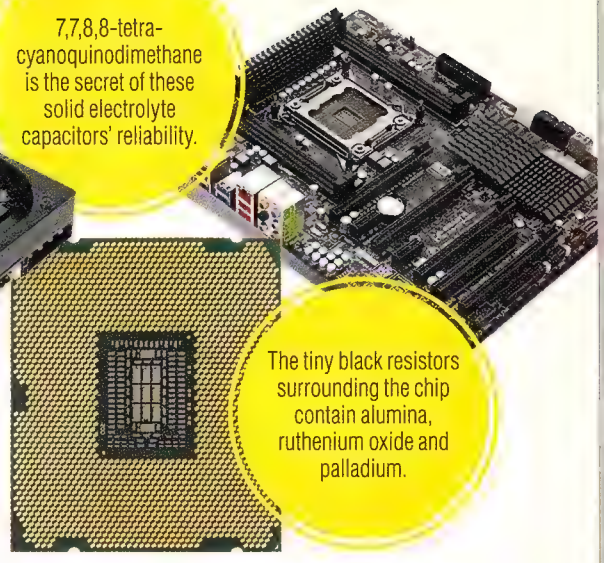
Passing a high-voltage pulse of current through a tube of xenon produces intense white light.



Copper isn't nearly as rare as some of the elements in a PC, but the scale of its extraction is staggering.

To look at the platter of a hard disk you'd think it was made from a single material, but its manufacture involves combining several rare and expensive metals.

7,7,8,8-tetra-cyanoquinodimethane is the secret of these solid electrolyte capacitors' reliability.



The tiny black resistors surrounding the chip contain alumina, ruthenium oxide and palladium.

dielectric. Of course, things are rarely that simple and a motherboard will contain lots of different types of capacitor, each suited to a particular application. Those with the lowest capacitance (measured in farads) tend to be ceramic capacitors. They look similar to resistors, but their construction is different.

The dielectric is made from ceramic, which is plated with silver to form the two metal sheets. This structure is stacked vertically to achieve the necessary capacitance without taking up too much space on the PCB. If they were built this way, the large capacitors that are needed in a PC's power supply and audio circuitry would be huge, so various types of electrolytic capacitors are used instead.

The original type of electrolytic capacitor was formed by rolling up layers of aluminium foil, sandwiched with paper soaked in an electrolyte. That electrolyte was usually boric acid or sodium borate, with other materials added to prevent it from evaporating. You'll still see this type of capacitor on some motherboards as little metallic cylinders, but they have one drawback: if they overheat the electrolyte evaporates, causing the case to bulge or burst and gunge to leak out all over the motherboard. Needless to say, this doesn't have a particularly beneficial effect on the workings of the PC.

Liquid electrolyte capacitors are being phased out in favour of so-called polymer capacitors, which brings us to that 7,7,8,8-tetracyanoquinodimethane, which provides a replacement for the liquid electrolyte. Polymers based on this organic compound are plastics, but unlike most plastics, they can conduct electricity.

One other important type of capacitor that can provide a particularly high capacitance for its volume is based on an element we've not come across so far. We won't go into detail about the capacitor's internal construction, but the element it uses is tantalum. Although it's a metal, tantalum has unusual properties that make it particularly suitable for manufacturing capacitors. But like hafnium, our supplies are running out. It's not that it's inherently rare – at one part per million in the Earth's crust, it's a thousand times more abundant than ruthenium. The problem is that for a variety of political reasons (not the least of which being that it's mined in the troubled Democratic Republic of Congo), experts have suggested that stockpiles will run dry sometime between 2015 and 2105.

If you know your way around the periodic table, you might know where to go if and when supplies of tantalum run out. Tantalum has an atomic weight of 73, which puts it in the group of elements known as rare earth metals. Immediately above it is element number 41: niobium. While it's not a rare earth metal strictly speaking, niobium has remarkably similar properties to tantalum, and is much more abundant. It looks much the same and has a similar density, melting point and boiling point to tantalum. Most importantly, scientists think it could form the basis of a new form of capacitor.

SOLDER

Unlike the big and expensive components like the processor and memory, which are fitted into sockets on the motherboard when the PC is built, the passive components are soldered in place by the motherboard manufacturer. Solder, the low melting point alloy used to make an electrical and mechanical connection between the lead or pin of a component and the copper track on the PCB, was originally made from tin and lead. The type normally used in electronics was 63% tin and 37 % lead, and had a melting point lower than that of pure tin, pure lead, or any other alloy of these two metals. Once again we're seeing that although an alloy is essentially a mixture of two metals, its properties aren't always intermediate between those of its constituents.

All that changed in 2006, when the European Union's Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) directives came into effect. Lead was banned in all consumer goods because of its toxicity and the electronics industry had to find a new form of lead-free solder. An alloy of tin, silver and copper is most commonly used and has a melting point a touch higher than old-fashioned lead solder. However, lots of other formulations have been used, with zinc or manganese being added to the mix to improve other properties.

AN ORGANIC FUTURE?

While silicon is perhaps the most important material in an average PC, we've unearthed a wide range of elements and compounds, without which modern computing would be impossible. It's been estimated that well over 50 of the 90 naturally occurring elements are used to make the digital age a reality. Many of these are in limited supply and for some there's no known alternative. Given the rate at which irreplaceable resources are being used up, we have to question how much longer we can expect business as usual.

There is a glimmer of hope, though. While each element has unique properties that can be matched by no other, organic chemistry can provide a means of designing molecules with the desired properties. What's more, the synthesis of organic compounds doesn't rely on esoteric and rare elements. Scientists have already produced conducting and semi-conducting polymers and built electronic circuits from nothing more than plastics, although as yet, they can't match the performance of silicon. Given the vast number of possible organic compounds, a PC of the future may contain no fewer amazing substances, but if the organic revolution takes off, the chances are they'll be radically different from the materials in today's PCs. APC

ALL-IN-ONE OPTIONS

If you want a decent toolkit without having to put it together yourself, PC Case Gear (**www.pccasegear.com**) sells a few options. **102-Piece Computer Tool Kit ($69).** This has almost everything you need to do open-CPU surgery on your electronic friend. **43-Piece Computer Tool Kit ($35).** While not totally comprehensive, this affordable kit has the basics for working on your PC.

PC TOOLKITS OF THE EXPERTS

From hackers to weekend tinkerers, every PC user needs a toolkit. You might be building a hardcore gaming PC, stress-testing your overclock or just cleaning the out years of dust and adware infections from your parents' computer. No matter what the job, the right tools are critical to getting it done. Lindsay Handmer interviewed the professionals and scoured the internet to put together the ultimate guide to building the perfect experts' PC toolkit.

THE TOOLKIT

You might prefer just to handle ones and zeros, but sooner or later you'll need to delve inside your PC.

Many new cases use tool-less designs so you can fiddle without even so much as a screwdriver to your name. But sooner or later you'll encounter a stuck thumbscrew or tough-to-pry-apart connector. Even just upgrading your RAM or installing an HDD can be a nightmare without basic tools. Still, you don't need a lot of tools to strip a PC down to its component parts, but having the right tool for the job can make the difference between fixing a PC and just causing further damage.

EVERYDAY ITEMS

These tools are essential for any PC guru. You probably already have a favourite hardware store, but a lot of online retailers stock quality tools for quite good prices. If you need a cheap and instant solution, a visit to a Bunnings store will sort you out. For more specialty products, such as soldering irons or canned air, Jaycar Electronics has you covered.

01 Screwdrivers

You can get away with just a few Phillips-head and flat screwdrivers for PC use. A screwdriver with changeable heads is often perfect, while magnetic screwdrivers can make it much easier to place and pick up loose screws.

02 Needle-nose pliers

Useful for unsticking motherboard risers, grabbing lost screws and holding things in place. The finer the tip, the better. However, sometimes a chunky pair can be helpful for bigger jobs.

03 Canned air

Nothing scares dust bunnies away as fast as canned air. Vacuum away as much of the build-up as possible first and then use the long nozzle to blow dust out of hard-to-reach places.

04 Thermal paste

If you plan to change heatsinks or reseat CPUs, a decent backup of thermal paste is a must-have. Most computer stores stock it, but look for a brand name and buy a large tube.

05 Multi-tool

If you're on the road you might not have your entire toolkit with you. Fortunately, a quality multi-tool can do a lot of what you need. Be extra careful, though – especially with fine screws – but it can be a lifesaver.

EXPERTS' FAVOURITE TOOLS

Don't just take our word for it – we contacted our favourite tech boffins and asked them what their favourite tools are. We asked for just the items they can't live without, rather than a long list. Check out our software tools on page 79 to find out more about the software these guys use every single day.

AMD

Custom cordless screwdriver We use a special extra-long tip to access right into the case.
Core Temp. A compact yet powerful program to monitor a system's temp and vitals.
AMD System Monitor. Built by us to display both basic and advanced system information from AMD hardware.

INTEL

Bootable Windows PE thumb drive. Offers essential tools like HDD partitioning and formatting. Windows PE can prep a computer for Windows, fix HDD issues, copy disk images and recover files.
Norton Ghost. Ghost provides a complete system backup and easy restore method for IT pros. There's no free version, but at $40 per licence, it's affordable.

ALTECH

Hitachi EBM315 Cordless Screwdriver. When you build PCs for a living, speed and precision is key.
Prime95 The best overclocking program, bar none.

IF YOU WANT TO MODIFY YOUR PC THEN A FEW MORE SPECIALTY TOOLS ARE IN ORDER

06 LED torch
Nothing is more frustrating than working on a PC under a desk or watching a screw disappear into a dark corner of your case. LED torches are bright, robust and have great battery life. Grab a headset-style torch for totally hands-free operation.

TOOLS FOR PC BUILDING

You can strip down a desktop PC with basic tools, although if you want to disassemble your GPU, open up your notebook or modify your PC then a few more specialty tools are in order.

Long magnetic screwdrivers
The long shafts let you get to all sorts of hard-to-reach places and are useful for retrieving lost screws. Long screwdrivers also help keep your fingers away from sharp edges.

Wire cutters
You might not actually cut that much wire in your PC unless you're doing some custom work, but side-cutting-style wire cutters are also very useful for trimming cable ties and stripping cables.

Antistatic strap/pad
PC hardware is fairly robust and isn't easily damaged by static. Still, if you plan to do a lot of work on your PC or modify circuit boards directly, it's always a good idea to have antistatic gear on hand as a precaution.

Multimeter
Even a basic multimeter can help you quickly track down power issues or check the voltages within your components. This is especially useful when modding your PC and you just can't figure out why your new lights won't come on. You can also buy dedicated PC power test meters.

Electric screwdriver
If you do a lot of work on your PC, an electric screwdriver can save you plenty of time. Chances are you'll need to buy a range of extra driver bits, especially the smaller sizes. If possible, try to get ones that are magnetic and use an extender shaft for easier access. As tempting as it is, don't ever use a drill with a screwdriver attachment on your PC. Sure, it might get that screw out super-fast, but you'll eventually strip the head, destroy the thread or slip and put a hole through your graphics card.

Corrosion remover pen
Over time, connections become corroded. Most of the sensitive hardware in your computer has gold-plated contacts that are extremely resistnt to corrosion, although many lesser joints can develop problems. You'll also find that fine sandpaper can work in a pinch.

Soldering iron
Chances are you won't be bringing out the soldering iron unless you're into some serious repair or modifications. A basic model will suffice for soldering in extra fans or lights, but a temperature-controlled model is a must for work like voltage-modding graphics cards.

Spare screws
While most cases come with plenty of screws, it's always worth keeping spares. We strip old gear and collect ours in a jar, but you can also buy extras.

Cable ties
These are essential for holding cables, lights and even fans in place. Read on for a more in-depth look into cable management, but an array of cable ties is often a lifesaver for even basic setups.

Tool bag
You can just throw all your tools into an old box on your shelf, but it's worth spending a little extra and getting a proper tool bag to protect your tools and keep them all together.

Hex bits
Most desktop PCs use standard Phillips-head screws, but occasionally you'll run into hex bits. A small kit will have you disassembling notebooks and looking inside dead HDDs in no time.

GAMEDUDE COMPUTERS

Based in Queensland, these PC-loving geeks have been building systems and selling parts since 1994.
Kincrome 200mm screwdriver. This allows us to remove even the trickiest components and screws.
Ultimate Boot CD. A compilation of very useful tools on one bootable CD.

PCG4M3R

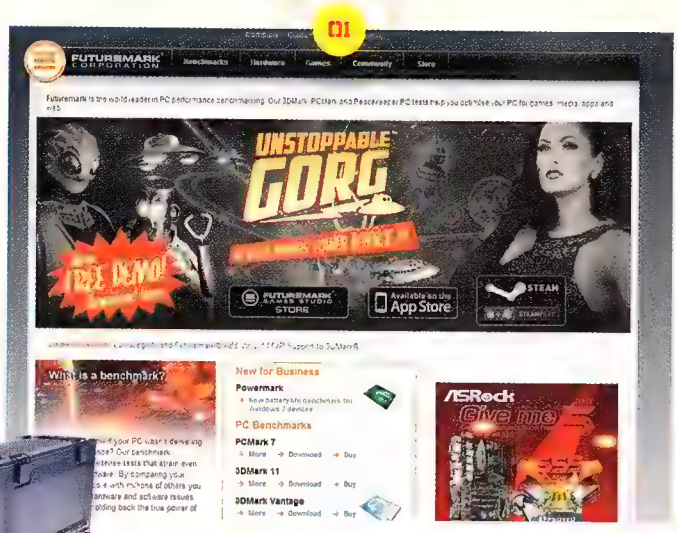
A gaming-focused Sydney retailer specialising in custom-built PCs.
Room 72 Stanley knife. Stolen from high school and with me ever since.
Steam. Aside from the typical testing software, we also love to play-test every last machine.

DINO STRKLJEVIC

Dino is a long-time overclocker and member of Team AU.
Compressor CPU cooler. Operates at 45°C to bypass the cooling limitations of CPU air or water coolers.
Gigabyte Tweak Launcher. Quickly and efficiently lets me control frequencies, voltages and memory timing.

HUNTER LEE

Hunter is a tech boffin from motherboard and graphics maker Gigabyte.
Cooler Master Hyper 412. Represents normal usage and typical user overclocks.
SYSmark 2012. This is great for testing overall system performance.



GENERAL TOOLS

Once you've built your system, you then have to test its performance.

BENCHMARKING TOOLS

A Google search will reveal a dizzying array of benchmarking tools. The following are the ones the experts use.

01 Futuremark

www.futuremark.com

Futuremark produces 3DMark and PCMark, two key benchmarks for Windows PCs. These are especially valuable, as they're used by thousands of people and have a huge range of results you can compare your system to.

3DMark has long been a core program for synthetically testing a gaming PC. 3DMark 11 is the latest version, with full DirectX 11 support. PCMark is designed to test a range of different PC performance options and is aimed at workhorse computers with light gaming performance tests. The basic version of both programs is free, though you can pay to upgrade for more features.

02 Cinebench

www.maxon.net

This popular benchmarking tool tests the performance of your PC with a 3D rendering test suite. It individually tests both the CPU and GPU for an overall performance score.

03 FurMark

www.ozone3d.net

This GPU test tool uses OpenGL and fur rendering algorithms to measure the performance of your video card. FurMark is also often used to stress-test a GPU for stability after overclocking.

SECURITY & SPAM

Sooner or later you'll either have to disinfect your own PC or be called in to resuscitate someone else's that has choked to death on malware. If the infections are bad enough, sometimes it can be quicker to reformat and

PHOTECH

This South Australian company specialises in parts and custom building PCs to your spec.

Jaycar cordless screwdriver. The whole team uses these to make building and repairing computers a breeze.

IntelBurn Test. Tests stability to make sure our customers are getting a rock-solid system.

MWAVE

Arguably Australia's largest online tech retailer.

Tweezers. If you drop a screw under your CPU cooler, sometimes tweezers are the only way to reach it.

Heaven DX11 Benchmark. Features extreme GPU loading for excellent benchmarking.

GR-TEK

Based in Abbotsbury, NSW, these guys have been building PCs since the early '90s.

Antec Digital PC Power Tester. A quick and simple way to check PSU voltages.

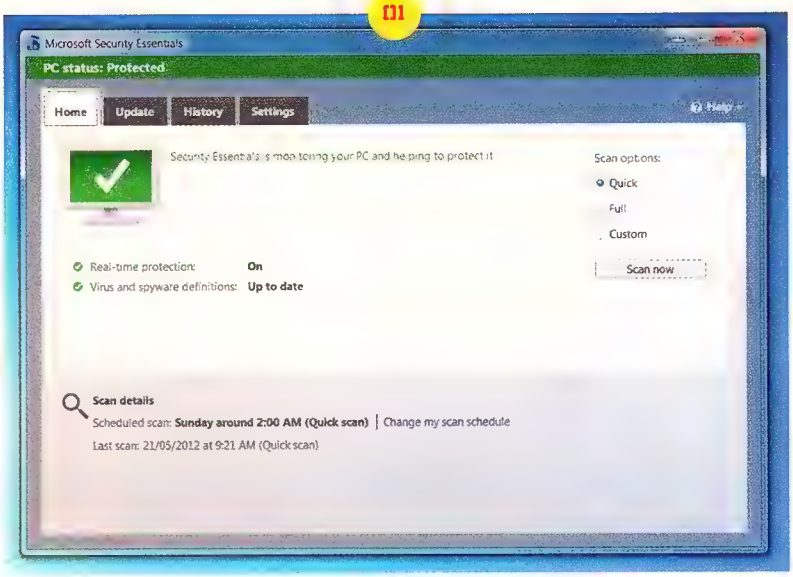
PassMark BurnIn Test. We run this for 12 hours on every new system build.

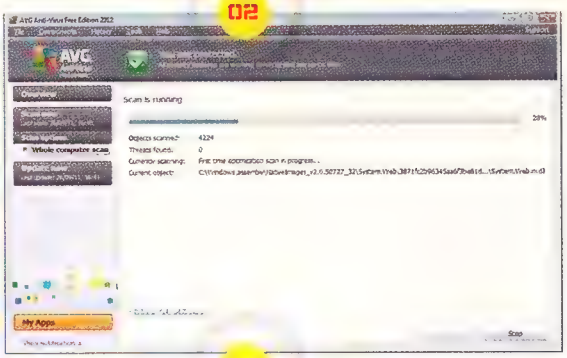
NIRV

Nirv specialises in building high-performance business, multimedia and gaming systems.

Electric screwdriver. It saves so much time compared to a regular screwdriver.

CPU-Z. While it's simple, it's very useful for checking BIOS versions, CPU information and more.





start from scratch. But if that's not an option, there are a bunch of programs and tricks that can help you stem the tide of spam. While all of these programs are good individually, sometimes you need to surround the enemy and hit it with every tool at your disposal.

01 Microsoft Security Essentials

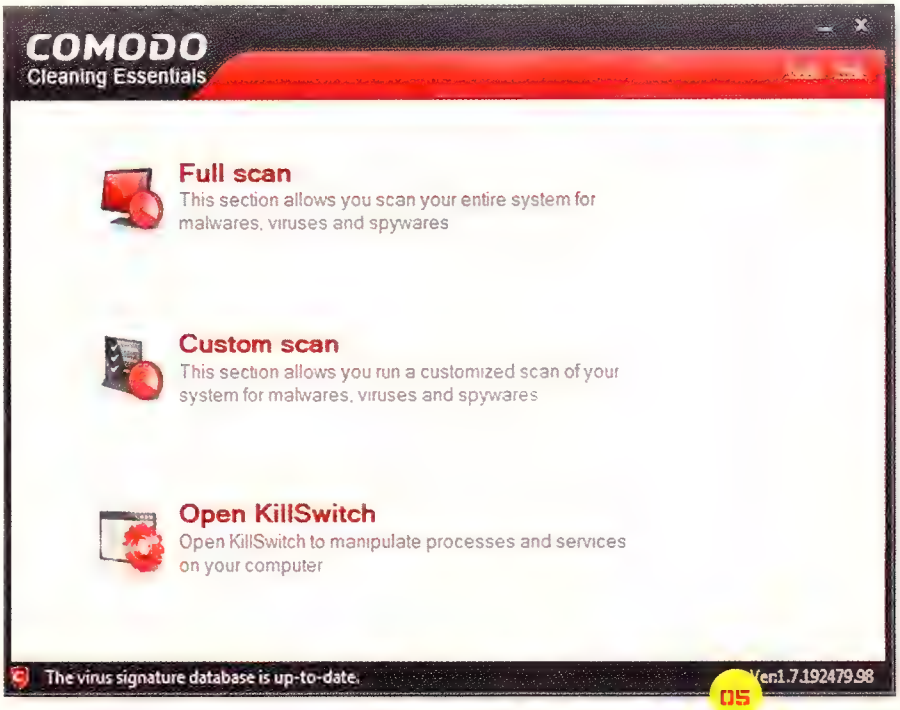
www.microsoft.com.au

If you're running Windows Vista (hopefully not) or 7, Microsoft Security Essentials offers excellent virus and spyware protection. It's totally free and consumes few system resources. It handles almost all problems and can run in the background with almost no user intervention. It's worth noting that you do need a genuine copy of Windows to install Security Essentials. We recommend you leave it running at all times for the best protection.

02 AVG Anti-Virus Free

www.avgfree.com.au

If you have an older version of Windows, want extra protection or were forced at gunpoint to download a pirated copy of Windows, we recommend you upgrade to Windows 7 and use Microsoft Security Essentials. Otherwise, AVG offers excellent free virus and spyware protection. AVG can also run on Linux, Mac OS and FreeBSD.


COMODO
Cleaning Essentials
Full scan
This section allows you scan your entire system for malwares, viruses and spywares
Custom scan
This section allows you run a customized scan of your system for malwares, viruses and spywares
Open KillSwitch
Open KillSwitch to manipulate processes and services on your computer
The virus signature database is up-to-date.
Ver:1.7.192479.98
05

03 Avast! Free Antivirus

www.avast.com

This comprehensive antivirus tool includes a bootup scan to remove malware before it can even launch. It also has an automatic sandbox feature that can stop suspicious programs not otherwise recognised as malware from doing any harm. Avast has a paid version that offers extra firewall and spam filtering options. There's also a new Mac OS version.

04 Malwarebytes Anti-Malware

www.malwarebytes.org

If you have a stubborn malware infestation that other programs just can't seem to clean, then Malwarebytes is probably the answer. It's specifically designed to hunt down and eliminate spyware, adware and even rogue security software. The paid version includes automatic scans and real-time protection.

05 Comodo Cleaning Essentials

www.comodo.com

Sometimes advanced malware can actively stop you installing new antivirus programs. Comodo can be run without an install and focuses on removing active malware. It's the perfect tool to keep on a USB flash drive for when you're inevitably asked to fix an overrun PC.

06 Panda ActiveScan

www.pandasecurity.com

If you don't have any tools on you, but you have access to the internet, Panda ActiveScan can be run from online. It does need to install a browser add-on, but it's a useful option when other antimalware programs won't run. We needed to run it under Internet Explorer 32-bit to make it work, though.

FORMATTING TOOLS

Operating systems (Windows in particular) have a half-life. As time rolls on, your PC seems to get slower despite any fixes or updates you perform. After a year or so, your PC is a sluggish shadow of its former self. The only real fix for this ongoing fossilisation is a fresh install of the OS. Especially when timed with a minor hardware update, it's amazing how snappy and fast a freshly formatted computer feels. For many, reinstalling your OS is a daunting task as you have to spend hours repopulating your main programs one by one. For PC experts, it's easy, thanks to a little tool called Ninite.

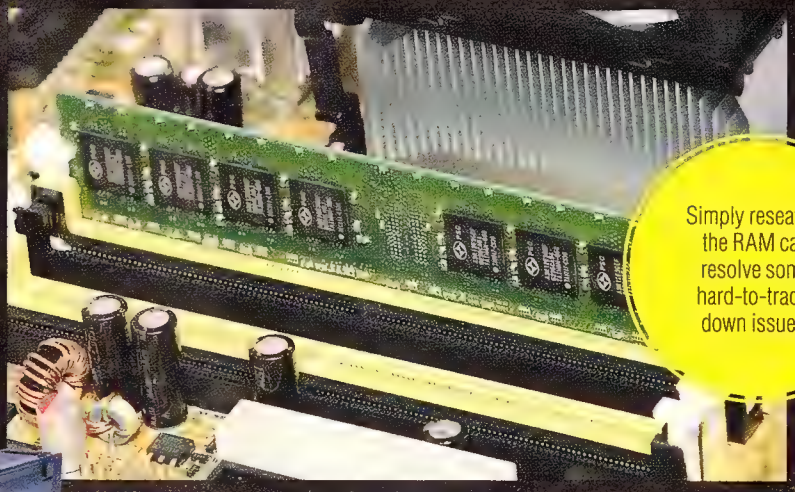
01 Ninite

ninite.com

Ninite is one of the most useful and easy-to-use tools for reinstalling programs on both Windows and Linux. Just go to the web site and tick the boxes for the programs you want, download the installer, and then kick back and let it make an otherwise tedious job incredibly easy. Ninite only installs the latest version of software, always says no to any opt-in toolbars or adware, and auto-detects if you need 32- or 64-bit versions of your programs. It runs in the background and can also be used to do simple mass updates of all the same programs any time you need. If you won't have internet access after a format, there's a Pro paid version with offline support that you can download in preparation.

Formatting tips

- Back up *everything*. Make sure you have every last picture, document and game save file saved on a separate HDD or online somewhere. If needed, you can also create a second HDD partition as a temporary backup directory.
- Installing the utility from a USB flash drive can help speed up the process.
- Make sure your BIOS is set to read your install media of choice first.
- Make sure you have the latest OS updates before you reinstall all your programs.



Simply reseating the RAM can resolve some hard-to-track-down issues.

TOP 5 TIPS TO GET YOUR PC BACK INTO SHAPE

As tempting as it is to fire up the latest whiz-bang troubleshooting programs or crack out the multimeter and poke around, you should always check the simplest options first. We've collected our top five tips from the experts to help you get your PC back into shape.

01 RESEAT YOUR RAM

A large percentage of screwy hard-to-track-down PC issues are caused by bad memory. Remove the RAM and use compressed air to clean out the socket and wipe the RAM contacts over with methylated spirits. Replace the RAM and check that it's solidly seated.

02 RESEAT YOUR CPU

While uncommon, sometimes removing your CPU and using compressed air on the contacts can fix hard-to-pin-down stability problems. It's also a good time to change old thermal paste.

03 MAGNETISE YOUR OWN SCREWDRIVERS

Get a powerful magnet (the back of a large speaker works) and stroke it along the shaft of the screwdriver from base to tip. Do this is as many times as you can until the screwdriver can reliably pick up screws. Magnetised tools can't hurt any of your hardware and won't affect your HDD in any way.

04 ARE ALL YOUR CONNECTORS SECURELY PLUGGED IN BUT NOT TOO TAUT?

Sometimes they can be not quite clipped in, or can work themselves very slightly loose from repeated heating and cooling cycles. To be sure, unplug it and then plug it back in.

05 DON'T USE CROSSFIRE OR SLI ON GRAPHICS CARDS THAT DON'T SHIP WITH THEIR OWN BRIDGE

It may just be voodoo, but multiple graphics card setups just never seem to be stable if you have to purchase a bridge.

THERMAL PASTE

Purists might argue that thermal paste itself is not really a tool, but it should be in every PC toolkit, is critical to any new build and using it properly is often a mysterious trick of the trade.

Thermal paste provides a complete microscopic contact between your processor and the heatsink for proper heat transfer. Old thermal paste can thicken and harden, and is best replaced. Getting as proficient with thermal paste as any other tool is surprisingly easy and first-timers shouldn't stress as it's quite difficult to damage anything. Keeping the CPU in the socket is a good idea to make sure you don't bend any pins or damage motherboard contacts.

01 Clean the old heatsink compound off the CPU and the heatsink itself. Methylated spirits and a clean rag or strong paper towel is ideal.

02 Apply a small amount of paste onto the CPU – remember, you're only filling tiny gaps. Three lines are ideal. Use an old credit card or similar and spread the paste in a thin layer across the CPU. Don't worry about perfect thickness – the heatsink will even it out.

03 Carefully install the heatsink. If significant paste oozes out the sides, you used too much paste, which can degrade heat transfer. Its conductive nature can also cause motherboard issues. Clean it up and try again.

CABLE MANAGEMENT, AIRFLOW & SOUND DEADENING

An expert will arrange HDDs, cooling and cables in a neat, coherent manner so future work and upgrades are as painless as possible.

Opening up a PC gives you an immediate insight into the mind of the builder. Amateur or rushed jobs can look like a rat's nest of wiring and have layouts that can bring a grown geek to his or her knees.

Many cases come with cable management routing and holes you can use to make the job simpler, but you'll also need an array of cable ties. The idea is to keep cables bunched together and out of the way to improve airflow and access to your hardware. Use your wire cutters to snip off the long cable tie tail as close to the base as possible to avoid sharp edges and to reduce clutter.

Properly put together PCs hum quietly along, whereas you can hear a bad build from across the room. Building a PC is more than just tightening everything up with a screwdriver – there are literally hundreds of noise-dampening options available. Rubber washers reduce rattles, while cooling fans can be mounted with flexible connectors. You can get silicone noise-absorbing pads for PSUs, HDDs and the noisiest beasts of all, optical drives.

It's shocking how many computer cases have badly set up or nonexistent airflow. Every time you open a PC, it's worth checking that it's getting the best possible cooling. Hot air rises, so install fans or vents to work with the resulting convection currents. Make sure that any high-mounted fans are blowing air out of the case and low fans are drawing it in. Make sure rear-mounted fans aren't working against a nearby CPU fan in an aftermarket cooler.

DIY TOOL: WINDOWS INSTALLER USB KEY

Having the right tool for the job makes any install easier, but sometimes you need to get down and dirty and put it together yourself.

Many new netbooks and some notebooks don't include optical drives, so trying to install your OS from DVD is just never going to work. Fortunately, thanks to a Microsoft utility and your favourite ISO creation software, it's easy to build the right tool to get the job done.

01 You need your Windows 7 install as an .ISO file. If you bought it through the Microsoft Store, you can directly download an .ISO file. If not, use your favourite ISO program (we like UltraISO) and create an .ISO file of your Windows 7 DVD.

02 Download the Microsoft Windows 7 USB/DVD Download Tool from **tinyurl.com/5r2wpfn**.

03 Obtain a 4GB or larger flash drive. A better-quality drive with a faster transfer speed is best.

04 Run the tool and follow the prompts to create your own bootable flash drive.

05 Make sure all your files are backed up. Insert the flash drive and reboot the PC. Make sure your BIOS is set to boot from the USB flash drive first.

06 Follow the Windows 7 prompts to install. You may have to remove the flash drive after it automatically reboots at the end of the install to avoid it loading up the installer again.

YOU ARE THE TOOL

Having specific programs and hand tools is an important part of working on your own PC, but your own knowledge is just as important.

How to undo a screw (lefty loosey, righty tighty) might be dead simple, but there are a bundle of lesser known yet still very useful skills every computer user should have. Of course, like Superman, you should keep your skills hidden day to day lest you be accosted by digitally challenged hordes looking for someone to fix their PC.

WINDOWS SHORTCUTS

Windows shortcuts can save a lot of time and effort, and are one of the easiest-to-use tools in the proverbial PC expert's arsenal. While you probably already know the basics, getting a few more of these down pat can make using a PC much more rewarding, not to mention faster. If you don't regularly use hotkeys, try to memorise a new one each week and you'll be pleasantly surprised by how useful they are. Below is our pick of the litter.

Click'n'shake. Click and hold the title bar of a window you want to keep maximised and shake the mouse. All other windows will minimise.
Alt+Tab Scroll through open programs.
Windows key+Tab Scroll through open programs with an easy-to-use 3D interface.
Ctrl+Z. Undo your last action.
Drag window to top. Maximise.
Drag window to the far left or right. Docks the window to fill half the screen.
Windows key+number. Launches the corresponding program in the taskbar.
Windows key+up arrow. Full-screens active window.
Windows key+left or right arrow. Docks the window left or right.
Windows key+down arrow. Minimises the active window.
Windows key+Home. Clears all inactive windows.
Alt+up arrow. Moves up a level in Windows Explorer.
Shift+Click+taskbar program. Opens a new instance of the program.
Windows key+F. Opens Windows Search.
Windows key+E. Opens Windows Explorer.
Windows key+Pause. Opens system properties.
Ctrl+Shift+N. Creates a new folder.
Ctrl+Shift+Esc. Opens the Windows Task Manager.
Ctrl+Enter on browser URL. Adds **www.** before and **.com** after.
Windows Key+D. Minimises or opens all windows.
Windows Key+L. Opens the lock screen – a must in a shared environment.
Ctrl+mouse wheel Zooms in and out.

CREATE YOUR OWN HOTKEYS

While many PC users regularly use some of the default Windows hotkeys, you can also set up your own with the free program WinHotKey (**winhotkey.en.malavida.com**). Aside from custom hotkeys you can also set up macros, such as different email signatures. Higher-spec keyboards and mice also often include software that lets you do the same thing and have a handy array of extra buttons to suit.

USB TOOLBOX

If you spend a lot of time fixing PCs or just like tinkering, then building your own ultimate USB recovery tool is a good bet. Large flash drives are so cheap nowadays that you can set one up with your favourite boot utility, such as Ultimate Boot CD, as well as include a directory of all your favourite antimalware and recovery tools. For total preparedness, buy a keyring flash drive so you have it on you at all times.

POWER MANAGEMENT

While it's especially important on a notebook, manually managing your computer's power settings has a number of advantages. Depending on your usage, you can make sure the computer is always ready for action or ensure it powers down the second you're not using it. Power management can also help reduce your electricity bill each year and make up for a brilliantly overkill new GPU.

CREATE OR MANAGE STRONG PASSWORDS

If you're anything like us, a complex password can be tricky to remember. Instead of trying to get in every last character combination, try using an entire phrase such as this: 'iprobablyshouldbeworkingrightnow'. It might look like a weird password, but chances are you'll easily remember it each time you log into Reddit. Long passwords are also much more difficult to crack.

If you use a lot of passwords, but use each infrequently, a password manager tool is a better option than using the same password everywhere. KeePass (**www.keepass.info**) and LastPass (**lastpass.com**) are both popular password vaults. They let you keep a database of all your passwords and use a single password to secure them with some of the highest-level encryption available.

When talking passwords, it's also worth mentioning that while most of us have our Wi-Fi secured with WPA or WEP, it's surprising the number of people who leave their router logins set to the default.

MICROSOFT PROBLEM STEPS RECORDER

This handy little tool can't do much on its own, but in the hands of an expert it can be used to quickly create a very handy and easy-to-follow how-to guide. PSR automatically captures the actions and steps you take on a computer, and includes a screenshot every time you click, as well as a text description of what's going on. You can save the captured steps and send the file to someone for playback in most modern web browsers. It's only in Windows 7. To run it, type psr.exe into the 'Start search' box on the Start menu.

BACKING UP

We all know we should, but not many of us do. Sooner or later the time will come when you'll wish you had backed up your system. The proliferation of free online storage such as Google Drive and Dropbox make it incredibly easy to keep our files safe. If the limited storage of the free versions is an issue, buying almost unlimited storage space is actually quite cheap.

SOFTWARE TOOLS RECOMMENDED BY THE EXPERTS

Want to use the same software as champion overlockers or AMD boffins? We've summarised the most popular software tools used every day by tech experts for both work and pleasure.

01 Core Temp
www.alcpu.com/CoreTemp
This widely used utility displays temperatures from each CPU core using the hardware's inbuilt sensors. It also shows hardware information and current frequencies.

02 Prime95
www.extremeoverclocking.com
While originally designed to calculate prime numbers, this tool also includes a torture test mode that can quickly show CPU instability. It can also be used to score a CPU's performance.

03 AMD System Monitor
www.amd.com
While aimed at AMD products, this handy tool shows CPU and GPU utilisation, core frequencies and even displays a readout on memory usage. Stats are tracked and displayed over time.

04 SYSmark 2012
www.bapcostore.com
This tool is designed to assess system performance based on real-world applications. Since SYSmark isn't free, it's mostly used by large companies rather than end users.

05 IntelBurn Test
downloads.guru3d.com
This hardcore tool is designed to push even the most powerful processor to its limits. Its claim to fame is the ability to raise temperatures beyond any other stress-test software available.

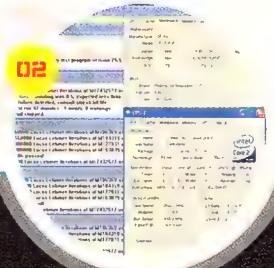
06 Super PI
www.extremeoverclocking.com
This tool calculates Pi to millions of decimal places to check performance and stress-test a CPU. It's often used to compare Pi calculation times and demonstrate overclocking prowess.

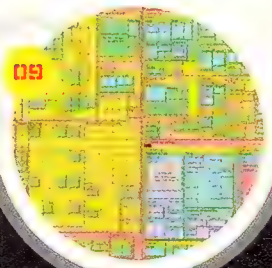
07 Hiren
www.hiren.info
This versatile boot CD includes a huge array of useful utilities and troubleshooting tools in one package. It's very useful for recovering your PC from a range of issues.

08 PassMark BurnIn Test
www.passmark.com
This professional stress-testing tool is designed to target all hardware, not just the CPU or GPU. It includes a free trial for 30 days and then has a paid Pro and Standard Edition.

09 SpaceMonger
www.sixty-five.cc/sm
This software graphically represents you data with tree maps and charts to make tracking down lost space easy. SpaceMonger also lets you manipulate the data directly and can copy, delete and move files.

10 Heaven DX11 Benchmark
www.unigine.com
Based on the Unigine Engine, this free benchmark tests DirectX 11 GPUs and supports multiple monitor setups. It's also useful to have for when you need to stress-test your video card overclock to check for stability.





ONE COMPANY, MANY TOOLS

Piriform
This company is absolutely chock-full of tech experts, so it's no surprise it provides four of our favourite PC software tools. All the programs are free, but there are also paid professional versions.

CCleaner
Totally scrubs out your Windows or Mac computer. It removes temporary files, history, cookies, autocompletes, recent files, log files and gets rid of old and unused registry entries.

Defraggler
A solid tool for defragging your Windows HDD. It can also defrag individual files and it supports both the NTFS and FAT32 file systems.

Recuva
A powerful yet easy-to-use data recovery tool. It can restore lost files from your PC, media card or other USB-connected device such as an MP3 player or phone.

Speccy
An advanced system information tool for your computer. It brings all your stats into one easy-to-read place and gives very detailed information on all your hardware.

YOUR OPEN-SOURCE DIGITAL TOOLKIT

There are excellent software tools available that can make working on the ones and zeros in your PC a whole lot easier. So many of the best are free and open source that it's not even worth worrying about paid options.

01 7-Zip
www.7-zip.org
7-Zip can pop open just about any zipped file you need.

02 DriverMax
www.innovative-sol.com
This automatically hunts out and installs the latest versions of your drivers for you. You can also export your current drivers before a format for an easy reinstall later.

03 DriveImage XML
www.runtime.org
Quickly back up entire drives and partitions to image files, then browse the backups, extract files or restore them.

04 Synergy
synergy-foss.org
Lets you simply network share your mouse between multiple computers by moving it off the edge of the screen. It supports copy and paste, on Windows, Linux and Mac OS.

05 WinDirStat
windirstat.info
This small utility is a powerful disk usage statistics viewer for Windows and shows the result in colourful graphs sorted by file type.

06 Copernic Desktop Search
www.copernic.com
This indexes your HDD and improves search functionality. This tool will help you find lost files as well as speed up day-to-day searches.

07 SmartClose
www.bm-productions.tk
Instead of just ignoring when new installs ask for all other programs to be closed, this tool closes them for you. Once finished, it restarts them automatically.

08 VirtualBox
www.virtualbox.org
Allows you to run entire OSs like a program. Great for testing new Linux distributions or playing with an alternate OS.

10 EULAlyzer
www.brightfort.com
Instead of skipping past complex EULAs, fire up EULAlyzer and quickly make sure you're not opting in for adware or toolbars.

09 TrueCrypt
www.truecrypt.org
This disk encryption software works on the fly to encrypt a partition or create a virtual encrypted disk inside a file.

11 DisplayFusion
www.displayfusion.com
DisplayFusion sets up dual monitors to work seamlessly as one and gives a bunch of extra options to boot.

12 Glary Utilities
www.glarysoft.com
This powerful and multi-faceted PC maintenance tool can clean your registry, protect against spyware, manage startup programs, optimise your PC and more.

13 Sysinternals Suite
www.sysinternals.com
This collection of troubleshooting tools is an excellent resource aimed at advanced PC users and IT professionals.

14 Ultimate Boot CD
www.ultimatebootcd.com
This collection of diagnostic tools is combined together to create the ultimate boot CD for troubleshooting or repairing PCs. You can also run it straight from a USB flash drive.

15 EaseUS Partition Master
www.partition-tool.com
This versatile software lets you manage your HDDs and partitions.

16 Free Opener
www.freeopener.com
This tool can wrangle open over 70 different file formats. Watch the installer carefully – the default options include extras such as the Ask Toolbar.

17 Wireshark
www.wireshark.org
Designed for expert use, Wireshark is a very comprehensive protocol analyser and packet sniffer. Now considered the de facto standard for network analysis.

18 CPU-Z
www.cpuid.com
CPU-Z is a simple yet powerful tool to show CPU specs like frequencies and multipliers.

19 HWMonitor
www.cpuid.com
A hardware monitoring program that shows voltages, temperatures and fan speeds. Display current values plus minimums and maximums.

20 GPU-Z
www.techpowerup.com/gpuz
A lightweight utility that displays specs, temperatures and clock speeds for your GPU.

21 ThrottleStop
tinyurl.com/7j2wg3l
Automatic CPU throttling on notebooks can reduce performance under load and ruin gaming long before temperatures reach problem levels. This tool lets you monitor throttling as well as disable it.

AN OS BY ANY OTHER NAME

For this latest instalment of our ongoing series on Windows 8, Ashton Mills looks at one of the most controversial facets of any Windows release — the naming and versioning — and how this will have some unintended consequences for media playback.

Ever since Windows XP, Microsoft has copped a lot of flak when it comes to the different versions of Windows – more so with the release of Vista and 7 – with Redmond seemingly intent on making the widest range of confusing product variations. Both Vista and 7 sport six different core editions each, not including the 'N', upgrade or x64 versions on top of these.

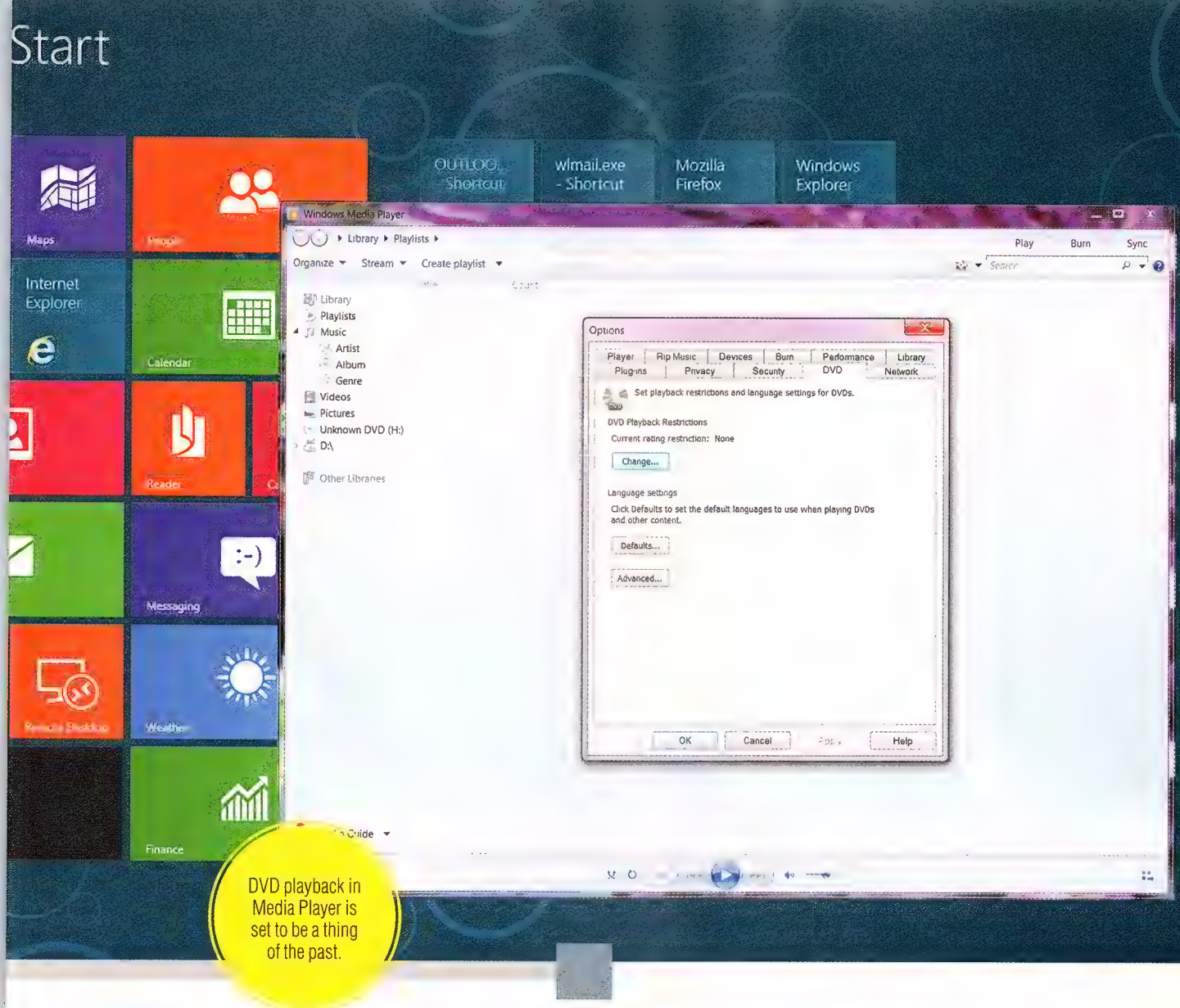
Along with every other area of Windows 8 that has garnered scrutiny for Microsoft, thankfully the number and range of editions is also on the cards – we're not quite at a simple single edition yet but according to Brandon LeBlanc, one of Microsoft's communications managers, Windows 8 has been trimmed down to just three simple versions: Windows 8, Windows 8 Pro, and Windows RT. Here's a breakdown of what you get in the box.

- **Windows 8 –** The core operating system in 32- or 64-bit flavour, much as you're seeing and using now with the Windows 8 Consumer Preview version.
- **Windows 8 Pro –** Bundles Windows 8 with extra features for 'professionals' (or enthusiasts) and business, such as encryption (both file system and BitLocker), domain connectivity, virtualisation support (including client support and booting from a VHD), remote desktop host support and PC management.
- **Windows RT –** Somewhat confusingly named in relation to WinRT, which is the Windows Runtime that's integral to all versions of Windows 8 itself, Windows RT is the first version of the flagship Windows for the ARM architecture. It's designed for low-power ARM-based tablets and can't be purchased standalone. It's destined for OEMs to be preinstalled. It has almost the same features as Windows 8 with one significant difference: it also bundles in Microsoft Office (Word, PowerPoint, Excel and OneNote). However, and importantly, traditional x86 Windows apps (ie. everything ever made for Windows to date) won't run on the ARM version and vice versa. This is presumably why Windows RT comes with the ARM version of Office – it won't be available as a separate product and conceivably bundling it for tablets is an extra value-add.

It's interesting to note how the breakdown has moved from core features and media support with previous versions of Windows to platform support between x86 and ARM. And with Windows RT not available to the public, it basically leaves just two versions.

Well, mostly. It's never quite that simple is it? First, while we haven't heard much about it, there will be an Enterprise version for big business; secondly, and quite significantly, there is one feature absent from all versions: Windows Media Center.

It's significant not because everyone might want or need Windows Media Center to run their own media playback box for the lounge room, but because features such as DVD playback and digital TV only come with Windows Media Center now, and it comes at an extra cost.



DVD playback in Media Player is set to be a thing of the past.

This means that Windows 8, much like Linux with a fresh install, can't play DVDs out of the box.

While the Windows 8 Consumer Preview currently features Media Center, with the final release unless you opt to buy what Microsoft is calling the Windows 8 Media Center Pack or the Windows 8 Pro Pack (an upgrade for Windows 8 to Windows 8 Pro), your Windows 8 won't be able to play back your DVD collection or let you watch digital TV. Currently, Microsoft hasn't announced the pricing for these upgrade packs, but says they'll be 'economical'.

It's also important to note that Microsoft seems oblivious to the confusion this creates with the upgrade packs: buying the Windows 8 Media Center Pack will give Media Center for Windows 8 Pro users, but Windows 8 users need to buy the Windows 8 Pro Pack to get Media Center. The Pro Pack also upgrades them to Windows 8 Pro, which means 'Windows 8 Pro' can refer to the Pro edition of Windows 8, both with and without Media Center, depending which path a user takes. There's no standard naming convention and doesn't guarantee what features a user can expect if they find a 'Pro' edition on a PC that doesn't actually include Media Center.

Importantly, it's not possible to get Windows 8 with Media Center – you need to buy the Pro Pack, which includes functionality like domain connectivity, virtualisation support along with BitLocker, even if you don't intend to use these.

UPGRADE PATH FOR MEDIA CENTER SUPPORT

Starting point
OEM preinstalled, clean install, or upgrade.

Windows 8 Pro

Windows 8

End-user upgrade
Acquire and install via 'Add Features to Windows 8'.

Windows 8 Media Center Pack

Windows 8 Pro Pack

Ending point

Windows 8 Pro with Media Center

THE PROBLEM WITH LICENCES

But why do you need Media Center – again, largely used for media streaming, playback and recording for the lounge room – to play DVDs or watch digital TV?

For Microsoft, it comes down to a split between functionality and cost. According to Microsoft's metrics, video entertainment is increasingly being consumed through online sources: services like YouTube, Netflix, Hulu and others. For this, Microsoft wants to ensure that Windows 8 can play back from it these sources, and so includes the appropriate codecs to do so.

And while this still requires royalty payments, DVD playback, Blu-ray playback and digital TV decoding (such as DBV-T/S) requires further payments for the appropriate licensed codecs; for example, DVD and Blu-ray require royalties to Dolby Laboratories. Previously, Microsoft has footed the bill for some of this (or technically, it's included in the purchase price you paid for the OS), but the company is no longer willing to do so. Part of the reason is that Windows 8 is designed to run on a greater variety of platforms, including tablets, and licensing these codecs will cost considerably more given the extra editions Microsoft expects to sell across all platforms, some of which (like tablets) don't even have optical drives. So why pay for what may not even be used?

As a result, if you need DVD or digital TV support, you'll need to either buy the Windows 8 Media Center Pack, or opt for one of the many third-party solutions available to provide this functionality – something which has always been required for Blu-ray playback regardless. And in fact, Microsoft has said that it's happy to offload this to third-party applications, which themselves will have had to pay royalties.

Hopefully, however, this will translate to a slightly cheaper product price, given licence royalties are no longer required. And to its credit, while Microsoft could have created a Windows 8 with Media Center edition, by keeping it as an optional paid upgrade, we get to have just the two standard versions of Windows 8 that make it easy to choose what version is right for you (minus, perhaps, the confusion between Windows 8 Pro and Windows 8 Pro that happens to include Media Center from an upgrade pack).

So what if you already have DVD playback support in Windows 7 and upgrade? According to Microsoft, you're out of luck – DVD licensing royalties don't carry forward to future Windows versions, so upgrading to Windows 8 will disable any current support you have, unless you purchase the Media Center upgrade pack.

Finally, it's worth noting that even if you've purchase the Media Center upgrade for Windows 8, you'll still only be able to play DVDs or watch digital TV in Media Center – the classic Media Player you've come to know in Windows 7 won't be able to play DVDs in Windows 8, even if the required codecs are installed.

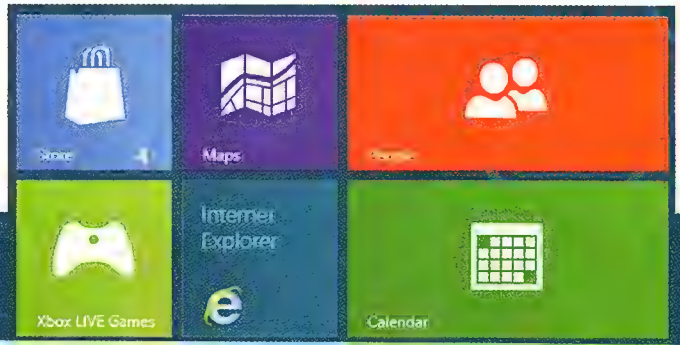
LOOKING AT THE FALLOUT

Somewhat understandably, this has created a bit of a furore on the Microsoft blogs from users expressing disappointment at the move (perhaps exemplified by a user who said, with a play on Metro, "Touch is great, except when you're out of it!") and while slowly phasing out (and paying for) DVD support makes some sense, Blu-ray is now the de facto for physical media, so it's interesting that Microsoft didn't go the route of adding Blu-ray playback to Windows 8, as many third-party products have their own interfaces inconsistent with Windows (and especially now, Metro). An integrated solution would have been better and Windows Media Player is ripe for this. Would users pay extra for DVD playback? Maybe, depending on their DVD collection. Blu-ray playback? More likely, given its role as the new standard.

Also raised was the issue of requiring Media Center to play these

WINDOWS 8 FEATURES

Feature	Windows 8	Windows 8 Pro	Windows RT
Start Screen, Semantic Zoom, Live Tiles	x	x	x
Windows Store	x	x	x
Apps (Mail, Calendar, People, Messaging, Photos, SkyDrive, Reader, Music, Video)	x	x	x
Microsoft Office (Word, Excel, PowerPoint, OneNote)			x
Internet Explorer 10	x	x	x
Device encryption			x
Connected standby	x	x	x
Microsoft account	x	x	x
Desktop	x	x	x
Installation of x86/64 and desktop software	x	x	
Updated Windows Explorer	x	x	x
Windows Defender	x	x	x
SmartScreen	x	x	x
Windows Update	x	x	x
Enhanced Task Manager	x	x	x
Switch languages on the fly (Language Packs)	x	x	x
Better multiple monitor support	x	x	x
Storage Spaces	x	x	
Windows Media Player	x	x	
Exchange ActiveSync	x	x	x
File history	x	x	x
ISO/VHD mount	x	x	x
Mobile broadband features	x	x	x
Picture password	x	x	x
Play To	x	x	x
Remote Desktop (client)	x	x	x
Reset and refresh your PC	x	x	x
Snap	x	x	x
Touch and Thumb keyboard	x	x	x
Trusted boot	x	x	x
VPN client	x	x	x
BitLocker and BitLocker To Go		x	
Boot from VHD		x	
Client Hyper-V		x	
Domain Join		x	
Encrypting File System		x	
Group Policy		x	
Remote Desktop (host)		x	



With DVD playback being dropped, it will be up to programs like VLC to provide support.

formats, as opposed to simply upgrading Media Player. Microsoft says it's doing it this way to avoid confusion over a DVD-enabled version of Media Player and one without, but to us it would seem incredibly simple to allow Media Player to optionally use the codecs if they're installed from the Media Center upgrade pack instead of requiring you to run the full-blown Media Center instead. And this is to say nothing of digital broadcast TV support – we've spent plenty of hours with digital TV running in a window on the background of our desktop while we work, something that will be no more with Windows 8 (and that's just with the traditional desktop, let alone Metro).

The other side of the coin, of course, is those who *do* love using Media Center for a lounge room media playback and recording device will now need to buy the Pro version, or the Pro Pack, and get – and pay for – a whole bunch of features such as domain connectivity and virtualisation support that a lounge room media box simply doesn't need. For all the advances Windows 8 has made so far that we've covered in these pages, it would seem that Redmond's decisions over Windows 8 versioning and features is perhaps missing the point on a number of levels.

And as before, now that Windows 8 is now no more functional than Linux out of the box for media playback, it's only going to strengthen Linux (especially in regard to media centre functionality) with products like XBMC, with the exception that enabling DVD support in Linux is free.

It's worth remembering, of course, that Windows 8 is still in beta and it will be interesting to see if any of this changes prior to the final release of the OS.

WHAT ABOUT UPGRADES?

Traditionally, upgrade versions have been cheaper than purchasing a full wipe-the-disk version of Windows. Currently, leaving out the Enterprise edition for business, to upgrade to Windows 8 you must be using Windows 7 and the upgrade path looks like this.

WINDOWS 8 UPGRADE PATH

Windows 7 consumer version	Windows 8	Windows 8 Pro
Windows 7 Starter	x	x
Windows 7 Home Basic	x	x
Windows 7 Home Premium	x	x
Windows 7 Professional		x
Windows 7 Ultimate		x

CREATE YOUR OWN GAMES

Anyone can be a game developer, says Henry Winchester.

The creation of a game presents a plethora of challenges. Which engine should you use? Who should you collaborate with? What's the back story going to be and how are you going to present it? What colour scheme are you going to use? Have you got enough coffee to get you through all those long nights of coding and designing?

It's an overwhelming amount of intricate detail. Get something wrong and people will tell you. The internet will let you know. But good game design comes down to one simple thing: an idea; a single sentence. A physicist triggers an alien invasion. A gun is created that allows instantaneous travel between two places. A young man who can control time must rescue a princess.

Everything can be expanded from this point on, but it's important to always come back to that original point. The technique's not unique to games – the best novels, films, music and art start out as a simple, broad stroke that's layered and built upon until there's a finished product. This way, those crucial themes are never lost and the narrative never strays from its original path.

Not everyone wants to construct a complete game, though. The modding community is still huge, adding new content to games and correcting the mistakes original developers made. Like many creative industries now, it's become full of eager fans willing to work for free to have that chance to make it to the top and become the next Ken Levine or Gabe Newell.

The best thing about current games – and it's never been better – is that you probably already have the tools to make an entire game from scratch. Valve's Source SDK is a great place to start, but on top of that you've got the Unreal Development Kit, the Skyrim Creation Kit, Unity and Game Maker.

Compiling. The Source SDK process of combining all a level's geometry, textures, lighting and objects into something you can actually play and interact with. Big, complicated levels take a long time to compile.

SDK. A software development kit is a package with everything you need to edit and create files for a particular game. The tools within are often the ones used by the developers to build the game, and most are available completely free.

Our aim isn't to show you the finer points of coding your first triple-A title; it's to show you the tools available for game construction. We've used Valve's Source SDK to show what's needed to create a game, as well as detailed other engines and game creation programs.

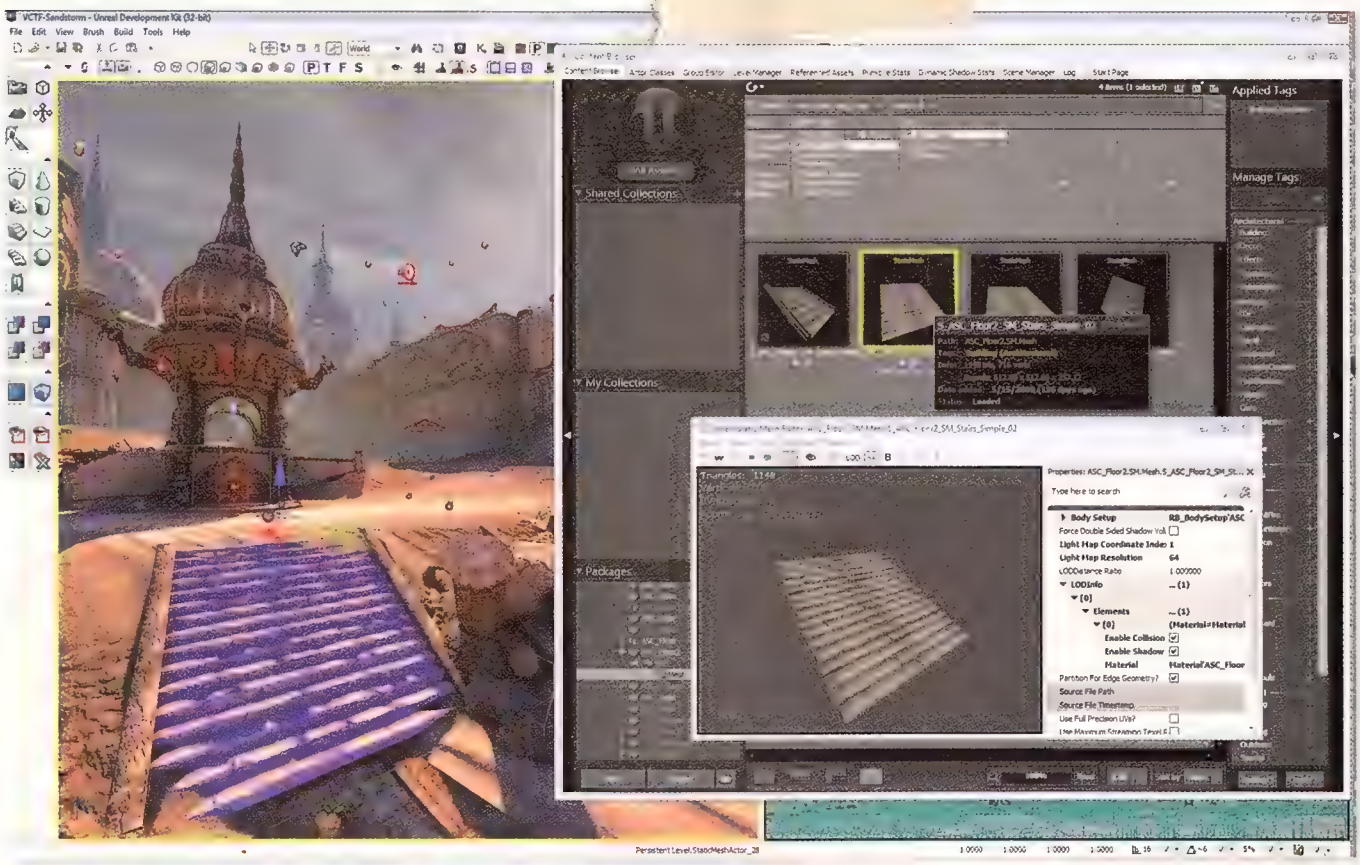
Essentially, there are two ways for budding game designers to get started in the field of game design. Modding is a tried and tested route, and a handful of big-budget titles and large studios began their illustrious lives as humble-yet-brilliant add-ons developed by a handful of people. Indie gaming is the plucky youngster of game design and standout games like *Braid* and *Minecraft* are often developed by one-man coding powerhouses.

Modding involves taking an existing game and altering its content. Just about everything in a game can be changed, from the look and dress of the characters to the colour of the sky, the design of the world, and the sounds and music. You can also alter and create scripted events, artificial intelligence routines and ways for the player character to interact with the world.

Modding has come on in leaps and bounds since the days of altering .WAD files with Doom Editing Utilities. Releasing mod tools is a win-win for publishers – not only do mods often correct or add content that should have been in the game in the first place (see *S.T.A.L.K.E.R. Complete*), but they can also be used by publishers to see what people want from games; what trends are gaining traction. A sudden rush of sci-fi mods for, say, *Skyrim* could push Bethesda into making another *Fallout* sequel.

MODDER'S TOOLBOX

So where do you get the tools to start modding? You've probably already got them. Open up Steam and click 'Library > All games > Tools'. Among the multitude of


VCTF-Sandstorm - Unreal Development Kit (32-bit)
File Edit View Brush Build Tools Help
Shared Collections
My Collections
Packages
Applied Tags
Manage Tags
Body Setup
Force Double Sided Shadow Vol
Light Map Coordinate Index 1
Light Map Resolution 64
LODDistance Ratio 1.000000
LODInfo ... (1)
Elements ... (1)
Enable Collision
Enable Shadow
Material Material'ASC_Floor
Partition For Edge Geometry?
Source File Path
Source File Timestamp
Use Full Precision UVs?

testscene.unity ~ Bootcamp ~ PC and Mac Standalone
Free Aspect
Camera
Clear Flags
Background
Culling Mask
Projection
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dedicated servers, you'll see authoring tools and SDKs for all the games you own. There's little difference between the content of the two, apart from the fact that authoring tools are specifically set up for one game and its intricacies. For example, *Portal*'s tool includes the ability to render those ubiquitous wormholes, which is pretty crucial to the game.

SDKs also include all the information you'll need to get started. You'll find a test level for you to play around with. There are models and objects to interact with. Some include documentation, but you'll find tutorials and walkthroughs on modding sites like **www.modwiki.net**, **developer.valvesoftware.com** and **www.moddb.com**.

It's worth noting that you need to have the game you want to mod installed on your PC. The SDK will give you access to literally every single little bit of the game, but it needs to have something to work with in the first place. Remember that games use different engines – *Half-Life 2*, *Left 4 Dead* and *Portal* use Valve's bespoke Source engine, whereas *The Elder Scrolls IV: Oblivion* and *Fallout 3* and *New Vegas* use the Gamebryo engine.

Before you even start getting to grips with modding, it's a good idea to just, y'know, play some games. Try to look at them as analytically as possible, try to work out what looks right for the setting, and what feels forced and unnatural. There are also games that can teach you a little about the basics of game design through playing them. *Minecraft* lets you create worlds using building blocks, which has parallels with level designers blocking out levels with LEGO. Garry's Mod serves as a great introduction to facial animations, models and physics, and lets you see how characters and objects interact.

DID YOU KNOW?

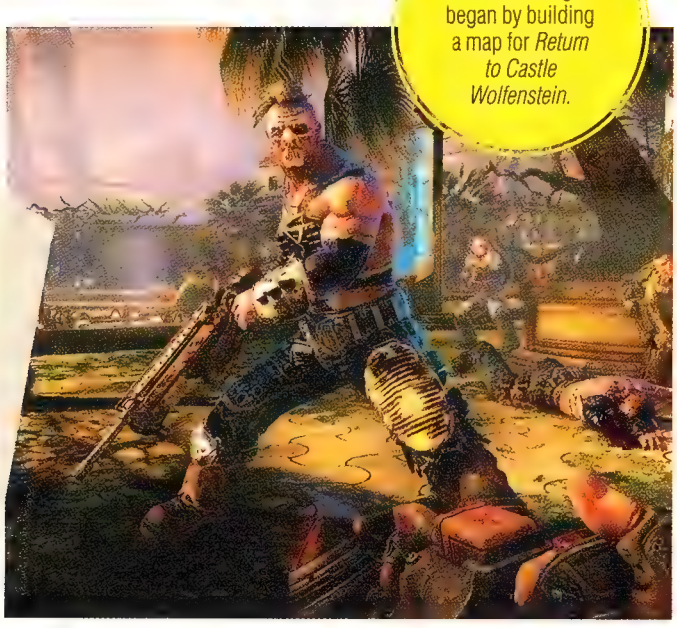
Half-Life 2* has more than 1,000 mods available on Mod DB (www.moddb.com), ranging from a *Jurassic Park* simulation to ports of *Mario Kart* and *Sonic the Hedgehog

One of the best ways to get to know the Source engine is to tie Dr Breen to a wheel and throw him around.

LEVELLING UP

At its most basic, any game consists of a level. This is the desolate landscape on which all the other elements sit. The undulations of a landscape or the sharp angles of an abandoned high-rise give visual cues as to the kind of environment we inhabit. Smart level design uses the environment to tell a story. Remove the characters and objects from *Rapture*, and you'll still have a pretty good idea as to what's happened there, for example.

While level editing is a complicated blend of art, maths and psychology, it's also a great way to introduce the basics of game design. The majority of elements in a game are made up of triangles wrapped around a wireframe mesh, which is why you'll never come across a perfectly round pipe or barrel in a game. The environment of the game is created this way, too



Brink developer Crash Damage began by building a map for *Return to Castle Wolfenstein*.

The best way to take those first tender steps into level design isn't through an SDK, though. It's through one of the most powerful and easy-to-use 3D programs in recent years: Google's SketchUp. SketchUp has been used to create everything from models of real-life locales in Google maps to photo-real models of planes. Although at heart, SketchUp wasn't really built with level editing in mind, its interface is very similar to that used in level editing software, and its intuitive nature makes it the ideal starting point for any kind of 3D modelling.

SketchUp packs a couple of other advantages, too. Valve's Hammer Editor now includes the ability to import models from SketchUp, so you can create detailed and interesting models that would be nigh on impossible in Hammer and import them. You'll find a plug-in for SketchUp in the Source SDK folder once it's installed. SketchUp is also handy for sketching out levels and seeing how they'll look and play. Its renderer is far faster than that of a game, so you won't have to wait around for your levels to compile before you can see what they'll look like.

Hammer is the natural step up from SketchUp. It's been around in various guises since 1996, when it was known as Worldcraft, and its fundamental interface and operation haven't changed a great deal since it was released alongside the original *Half-Life* back in 1998. It's compatible with the majority of Valve's recent releases, from 2004's *Half-Life 2* to last year's *Portal 2*. While it can look overwhelming to start with, working through a few tutorials can help you pick up the basics fairly quickly.

The key to Hammer's world-forging is the use of brushes. These are the basic blocks that are used to create the solid, static elements

Fairly complex architecture can be imported to Source games via SketchUp.

of levels – the floor, the walls, the sky and the water. Hammer uses a technique known as binary space partitioning (BSP) to render levels, which takes into account every angle from which the game space can be viewed. All levels created with Hammer must be contained in a completely watertight space because any light leaking out confuses the hell out of the compiler.

A level simply compiled of brushes would look incredibly dull and lifeless, so to liven things up, textures are applied. These are 2D image files that wrap around the 3D objects to make them look more real. Upping the resolutions of these images using graphics editing programs is a modding art in itself – this is how high-resolution texture packs are created. Hammer also allows you to control the lighting, be it the midday sun or a full moon, and adjusts shadows and highlights accordingly.

MODELS

The characters, objects and interactive props that inhabit Hammer levels are known as models. In the original releases of Hammer, these didn't include buildings, but later releases term some buildings as models. There's already a huge library of models in all Valve's games, which can be viewed using the Model Viewer, included in the Source SDK. Whereas editing maps in Hammer is fairly straightforward, creating custom models requires external programs – such as 3ds Max – and quite a lot of patience and skill.

The final piece of the Source SDK is the face poser, which as the name suggests, allows you to tweak facial animations and add custom voiceovers. *Half-Life 2* brought facial animations forward by light years and it's a surprisingly uncomplicated tool considering the advanced logistics of lip-syncing a pretend 3D face. The face poser is also used to create skeletal animations, such as walk/run cycles and hilarious falling over motions.

We're merely scratching the surface of the Source SDK here and there are thousands more things to consider. You'll run into problems – everything from 'Where should that tree go?' to 'Why is the level I've spent months working on crashing my computer whenever I load it?' It's all part of the amazing process and steep learning curve that comes with creating your first custom content.

Aside from Source's SDK, there's the Skyrim Creation Kit and Unreal Development Kit. Both work differently from the Source SDK

Tom's game is due in August. Probably. Follow his progress at *www.pentadact.com*.

INDIE INDEED

Games journalist Tom Francis's debut game *Gunpoint* sees a man infiltrate buildings and rewire light switches to kill people. Here he talks about being a one-man indie developer.

APC What was the main inspiration behind *Gunpoint*? Was there a central theme you wanted to explore?

TF I always wanted a game where the decision of whether or not to shoot someone was a big deal. So you can shoot anyone you like in *Gunpoint*, but because it's set in a city the shot will be heard and it won't be long before the police show up and block your escape route. So if you can, it's often wiser to keep someone at gunpoint — which makes them scared to shoot you — and slip away without firing.

APC How did the development process change this idea?

TF I accidentally came up with a hacking system that was way more interesting and fun to play with than the gunpoint idea, so the focus shifted to that. That became the Crosslink gadget, which lets you see all the electrical connections in the building and rewire them however you like. So you can disconnect a security camera from the alarm it normally triggers and link it to a door instead. When it sees you, instead of alerting the guards, it'll open the door and let you in. The gunpoint mechanic is still in there, but it's up to you whether you want that to be your play style, or you want to mess around more with electronic espionage.

APC Which tools are you using to create the game?

TF I'm making it in Game Maker, which is cheap, easy to use and doesn't require you to write any code if you don't want to.

APC What was the hardest part of creating the game?

TF The very, very basic stuff, like collision. Just getting a guy to bump into walls and change sprite without going into the wall, popping too far out of it or crashing the game. That's far harder than designing and coding a high-level game mechanic like the Crosslink.

APC What's the most satisfying part of making a game?

TF Seeing the player feedback from testing improve. It started out broadly positive, but with each round of testing I do, I see more and more excited responses, and that's awesome. Particularly when I still have lots more to add and improve.

because they're creating rather different games and worlds, and it's up to you to decide which best suits your grand vision. The Unreal Development Kit is in some ways friendlier than the Source SDK, but if you employ it you're basically going to be creating everything from scratch. The Skyrim Creation Kit is gathering momentum, but it's fairly limited to creating mods and new areas for Bethesda's ubiquitous RPG romp.

THE CODE ABODE

There's a fly in the ointment of all this, which is coding. While it's all well and good being able to create levels and maybe even skin a character, if they aren't acting how you want them to you're going to get quite frustrated. Source games use the universal language of C++ to dictate how the world works, whereas Unreal Engine 3 games use a bespoke language called UnrealScript or, as it's often abbreviated, uScript. This was built with ease of use in mind, whereas C++ is used in many different programming environments.

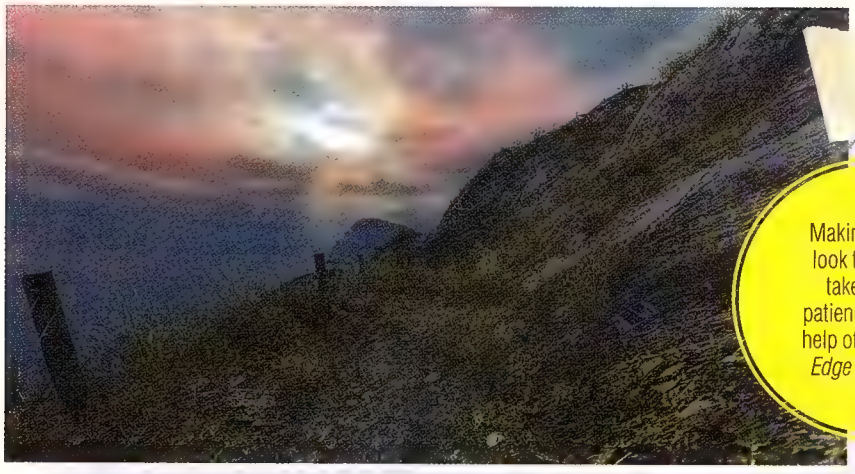
There are further issues to consider when choosing a game engine. In our view, the Source SDK is the best way to get started, but aside from authoring tools for specific games, it receives little to no love from Valve and isn't updated that frequently. The Unreal Development Kit is updated on an almost monthly basis and there's the added advantage that you won't have to hand over any royalties until your game makes over US$50,000. We'd say that the best approach is to use the Source SDK for getting started and beginning with mods, and then switch to the Unreal Development Kit once you're ready to make your first full game.

The final option here is Unity. This software was created with making 3D games in mind and a completely free version is available from **unity3d.com**. The main benefit of Unity is its cross-compatibility -- create a game with it and you'll be able to play it on everything from an Android smartphone to a powerful PC. It's yet to find its killer app, but it's gaining traction with games like *Battlestar Galactica Online* and *Tiger Woods PGA Tour Online*.

Of course, there's a more low-fi approach to making your first game -- and one that makes it far more feasible for a single person to bash out a completed product. Indie gaming has become far more popular in recent years, especially with the rise of the iPhone and casual gaming on sites like Facebook. Thanks to this low-spec hardware, ideas can come before graphical prowess.

The tools needed here are far less unwieldy than those required for 3D gaming, too. Quirky indie point-and-clicker *Machinarium* was created using little more than Adobe Photoshop, Flash and some beautiful hand-drawn artwork. Bonkers dungeon crawler *Spelunky* was made with Game Maker, a piece of software that puts ease of use over programming skills.

Whether you choose to get into game design through modding or creating a whole game on your own, there are hundreds of possibilities. Hopefully we've shown you the best options for each and every type of game you can create, whether it's a complete overhaul for an aging game or a mere additional teapot prop for your favourite RPG.



Making source look this good takes time, patience and the help of a *Mirror's Edge* designer.

WE ARE THE MODS

Dan Pinchbeck, the University of Portsmouth's senior lecturer in creative technologies, began *Dear Esther* as a mod for *Half-Life 2*. *Mirror's Edge* environment artist Robert Briscoe joined the project and rebuilt the game from the ground up before it enjoyed an official release on Valve's Steam.

APC Did the development process affect your original idea of what *Dear Esther* was going to be?

DP Oh yeah. When we made the original mod we really were learning source so the environment was very basic and very much driven by what resources we had (none). So when Rob came on board, he had an amazing wealth of experience of making rich and deep environments, and that suddenly opened the door to doing much more interesting things with environmental storytelling.

APC Was the Source engine your original choice for developing it?

RB Source had (and still has) by far the largest install base and I'd already had years of experience working with it, starting my career in the modding scene, so it was a natural choice to stick with it! The limitations of the Source engine really forced me to be more creative with the artwork in *Dear Esther*, which really helped define the surreal, impressionistic, painterly style of the game, which I think plays an integral part in communicating the strange and ambiguous story.

APC What was the biggest problem you faced along the way?

RB The last level was an especially big challenge. It was one of the largest levels in the entire game and I also wanted it to outshine the others visually and detail-wise, with insane view distances both horizontally and vertically. The open nature of the level left me with no opportunities to occlude or cull stuff from view, so I had to use literally every trick in the book (and invent some new ones) in order to get it to work at a reasonable frame rate.

APC What's the biggest tip you'd give to budding game developers?

DP It's easy to have an idea for a game, a lot harder to start building it, a hell of a lot harder to finish it and even harder than that to get it released. So you just have to start anywhere. And don't be afraid to burn through ideas fast. Bin what doesn't work and don't get too attached until you hit the mother lode. You'll know when you've got something really worthwhile. And talk to people. It's an amazing community of people who love the medium and they're incredibly approachable and open.

ULTIMATE COLLECTOR'S EDITION
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JULY 2012
THE WORLD'S BIGGEST MOVIE MAGAZINE
TURN FOR BONUS CATWOMAN COVER!
IT ALL ENDS INSIDE
NOLAN CONCLUDES HIS TRILOGY
THE DARK KNIGHT RISES
THE COMPLETE STORY
Plus
DJANGO UNCHAINED
WOODY HARRELSON
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Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

INTERNET

MAKE INPRIVATE BROWSING THE DEFAULT SETTING

Q I routinely browse the web using Internet Explorer 9 in the InPrivate Browsing mode. Is there a way to start Internet Explorer so it always defaults to this mode instead of me having to open an InPrivate window manually each time after launching the browser?

Bruce Alexander

A You have two options. If you're running Windows 7 on your PC and you've pinned the Internet Explorer icon to your 'Start' menu or taskbar, you can access it directly from there. Either right-click the taskbar icon or click the '›' symbol next to the 'Start' menu icon and choose 'Start InPrivate Browsing' from the menu that appears.

If this is too much hassle – or you're running Windows Vista – you can still force the Internet Explorer shortcut to open automatically in InPrivate mode.

To do this, right-click its shortcut on the taskbar, 'Start' menu or desktop and choose 'Properties'. You need to add the -private switch to the end of the 'Target' box so it reads as follows: "C:\Program Files\Internet Explorer\iexplore.exe" -private (note the space between " and -private). Once this is done, click 'OK' and you should find that Internet Explorer automatically opens in InPrivate mode when you double-click this shortcut.

CAN'T SEND PHOTOS VIA WINDOWS LIVE MAIL

Q I'm unable to follow the advice in 'Emailing photos' from the April issue (see page 78). When attempting to change the photo settings to 'Attachment', I keep getting asked to sign in. I click 'Cancel' and continue, but then get told that I can't send the email. How do I fix this?

Norbert Singer

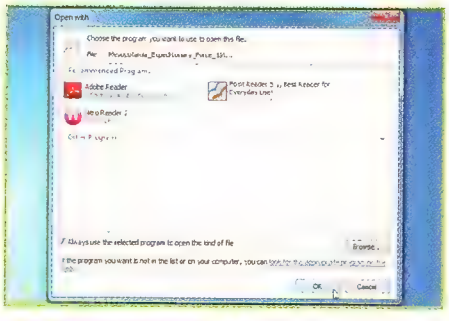
A It seems you need to be signed into a Windows Live account in order to use the photo service in this way. If you don't have an account and don't want to set one up, there is a workaround. Make sure you select a non-picture file (like a text file) along with the photos you wish to send, then right-click and select 'Send to > Mail

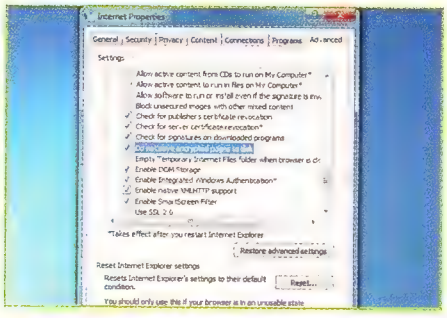
VIEW PDFs IN YOUR WEB BROWSER

Q I'm using Windows 7 Professional 64-bit and Internet Explorer 9, but I can't open PDF attachments in my browser. Is there a way to do this? Can you help?

Alfred Brameller

A Alfred was using Adobe Reader 9, but a similar troubleshooting procedure can be followed for other PDF readers, too. This step-by-step tutorial explains what you need to do to overcome this problem.


Open with
Choose the program you want to use to open this file.
Adobe Reader
Always use the selected program to open this kind of file
OK
Cancel

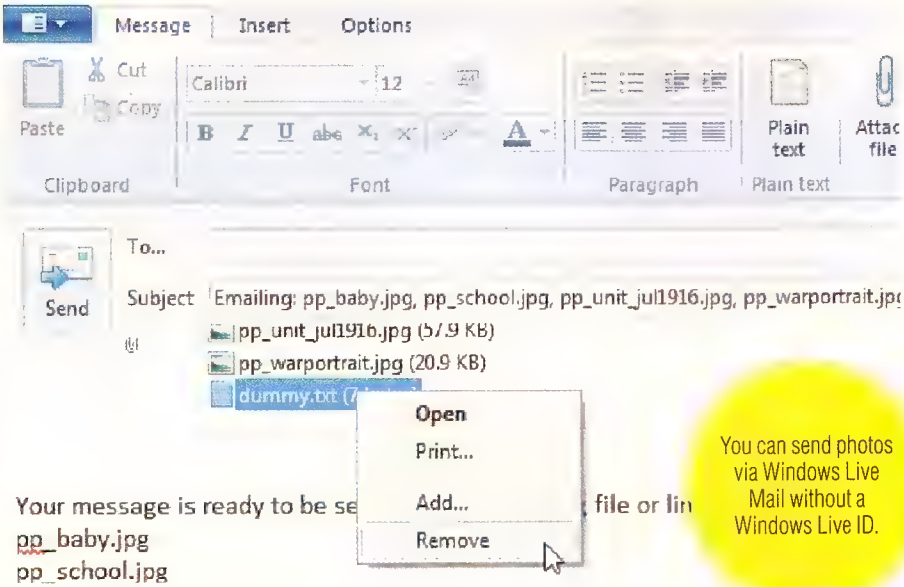


01 CHECK FILE ASSOCIATIONS

Locate a .PDF file on your computer and double-click it. Does it open in the correct app? If not, right-click the file and select 'Open with > Choose default program' and select 'Adobe Reader'.

02 TWEAK IE9 SETTINGS

Open IE, then click the cog icon and select 'Internet Options > Advanced'. Scroll down to the 'Security' section, tick 'Do not save encrypted pages to disk' and click 'OK'. Try opening .PDF files directly now.



You can send photos via Windows Live Mail without a Windows Live ID.

recipient'. You'll be able to resize your photos as normal and they'll appear as attachments with the additional file, which you can remove before completing and sending the email.

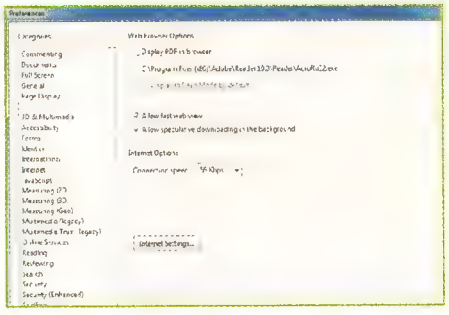
HARDWARE

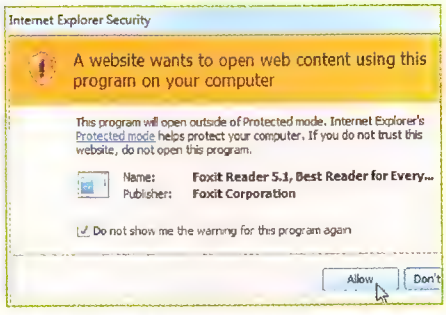
CAN'T CONNECT CAMCORDER TO PC

Q I recently bought an all-in-one PC, but I'm unable to connect my Sony camcorder to it, as there are no drivers for Windows 7 available. Sony tells me I should connect it via the FireWire port, but my PC has no such port and no means of adding one. How can I connect the two?

Roger Spratt

A Roger wanted to know if he could achieve a connection using a FireWire-to-USB adapter. However, these are unproven and wouldn't work in this case because the camcorder would still be recognised as a USB device, leading back to his original problem. With no FireWire port available, Roger has two options. First, he could install a spare copy of Windows XP in a virtual machine such as VirtualBox (**www.virtualbox.org**) and




Internet Explorer Security
A website wants to open web content using this program on your computer
This program will open outside of Protected mode. Internet Explorer's Protected mode helps protect your computer. If you do not trust this website, do not open this program.
Name: Foxit Reader 5.1, Best Reader for Every...
Publisher: Foxit Corporation
Do not show me the warning for this program again
Allow
Don't

03 DISABLE PDF PLUG-IN

If that doesn't work, disable the built-in PDF viewer by opening Adobe Reader, selecting 'Edit > Preferences > Internet' and unticking 'Display PDF files in browser'. Click 'OK'.

04 CHANGE PDF VIEWER

Alternatively, try a PDF viewer such as Foxit Reader (**tinyurl.com/4xfqzfn**). Open 'Preferences', select 'File associations' and tick 'Display PDF in Browser'. Try opening a link to a .PDF file in IE and clicking 'Allow' twice to view it.

QUICK QUESTIONS

Is there any way I can select multiple emails in Windows Live Mail? I can't find any checkboxes to tick.

Billy Weekes

There aren't any checkboxes in Windows Live Mail, but you can select multiple emails by holding Ctrl as you click on each one.

I have a Toshiba notebook whose motherboard isn't working. What are my options?

Paul Benedict

Repairing it yourself isn't cost-effective or easy, so we'd suggest trying a local repair service. This will be cheaper than sending it back to Toshiba or purchasing a new notebook.

Having had my child's notebook screen repaired, I've forgotten my administrator password, so I can't log in. Can I retrieve it?

Calvin Belton

*Use the free program ophcrack (**ophcrack.sourceforge.net**). We recommend downloading and burning the live CD version on another PC to recover your password.*

Is it possible to somehow remove or disable Windows Media Center in Windows 7? I don't have any use for it.

Graham Vine

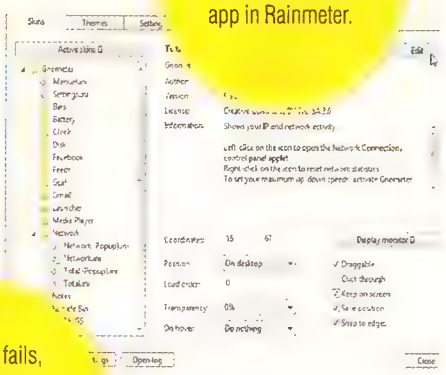
You can't uninstall Windows Media Center, but you can effectively disable it. First, click 'Start > Default Programs > Set program access and defaults'. Expand 'Custom', untick 'Enable access to this program' next to 'Windows Media Center' and click 'OK' to finish the task.

If I had a Windows 7 Home Premium product key, would it work with Windows 7 Ultimate?

Daniel Hall

You can't use the key with an existing Windows 7 Ultimate installation, but if you're referring to installing Windows 7 from an Ultimate install disc, then yes, you can use the key, which will give you Windows 7 Home Premium.

If all else fails, connect your camcorder to your PC via its analogue ports.



You may need to tweak the Network app in Rainmeter.

Kingsoft Office Suite Free is a good alternative to Microsoft Office Starter.

attempt to connect using that. It's a long-winded workaround and might not work, although VirtualBox's handling of USB devices has improved greatly in more recent times.

Roger's other option is to purchase a USB video capture device. This allows you to connect your camcorder's analogue video and audio out ports to the capture device with a suitable cable (you may have to provide this yourself) and then capture the footage in real time using Windows Live Movie Maker. Expect to pay around $70 for the equipment you need.

SOFTWARE

OVERLOADED SYSTEM PRODUCES ERROR

Q I installed Rainmeter to customise my desktop and it looks superb. However, one of the applications I downloaded, Network, is giving me concern about my bandwidth. It shows my ISP's IP address and claims my total upload in the past month is in excess of 2TB and the total download is 253GB. Is this normal and if so, what do the figures represent? I fear I've become part of a botnet.

Michael Game

A Those figures are so alarming they can't possibly be true (your ISP would be on to you if you'd uploaded just a fraction of that amount) and thankfully, this was the case with the Network app. We discovered that it's not too accurate and actually ends up monitoring all network traffic, not just your connection to the internet.

Michael then revealed that he'd been archiving many old DVDs and backing them up to a network-attached hard drive. This explains the extreme figures he's been getting: the amount of data being moved totalled a few hundred gigabytes and the process of 'uploading' them to the backup drive was being monitored by the Network app. To resolve this problem, follow the advice in the forum post at **tinyurl.com/cz7ppo7**.

PROBLEMS WITH OFFICE STARTER

Q I recently bought a desktop and a notebook, both of which came with Microsoft Office Starter Edition. While I'm able to launch it on the notebook, I can't get it to run on the desktop PC. The PC supplier suggested I use OpenOffice.org, but it has formatting differences and I would prefer to use Office Starter if possible.

Colin Palmer

A We directed Colin to an article on the Microsoft Office web site at **tinyurl.com/6pntfwk**, which explains how you can update, repair or remove Office Click-to-Run products like Office Starter. Unfortunately, this didn't work in Colin's case and he was left with a non-functioning version of Office Starter on his PC. Having exhausted the possibilities of repairing and reinstalling it, we were able to help Colin remove it from his computer. First, we instructed him to disable the Client Virtualization Handler service. To do this, click 'Start', type services into the 'Start search' box and click 'Services' under 'Programs'. Locate and double-click the service, then set 'Startup type' to 'Disabled', click 'OK' and then reboot your computer. We then asked him to try removing it again and if this still didn't to the trick, to uninstall it using the fix-it tool provided at **tinyurl.com/45x45**.

With Colin able to remove Office Starter, but still unable to reload the software, we pointed him towards a lightweight free alternative in the form of Kingsoft Office Suite Free (**tinyurl.com/5twtuwe**), which Colin was happy to report was an acceptable alternative to Office Starter.

TECH GLOSSARY

BANDWIDTH. A measure of data uploaded or downloaded over a network or the internet.
InPrivate browsing. A special mode in IE where no record of your browsing history — including cookies and searches — is kept after the window is closed.
ISP (Internet Service Provider). The company that provides you with your internet connection.
PDF (Portable Document Format). PDF files display documents from different apps in a single, exchangeable format.
VIRTUALBOX. A program used to run a virtual version of Windows.

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Share your tech tips

Have you solved a tech problem or found a better way of doing things with your computer? Share your information with other APC readers by sending it in as a tip to **contact@apctest.com**, together with your name and contact details (details won't be printed). Alternatively, if you have a technical question post it online on our forums at **apcmag.com/forums** and other readers may be able to solve it.

INSIDE

Antec's P280
PERFORMANCE ONE SERIES

We take a look inside the P280 and discover that behind this sleek exterior there is a range of features that will make your next build a breeze and provide you with the scope to really go to town with your choice of performance hardware.

Roomy Interior

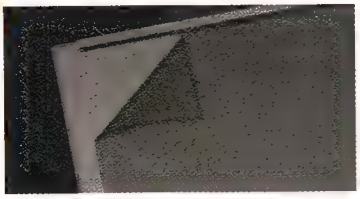
Makes it easy to work with has nine expansion slots and can accommodate up to XL-ATX motherboards.

Superior Cable Routing

Grommet-lined cable routing holes with 30 mm of space behind the motherboard tray.

Quiet Computing Dual-layer design

0.8mm steel/ polycarbonate side panels, dampen noise.



ALL THE SPECS

- **11 drive bays:**
  - 3 x 5.25" tool-less drive bays
  - 2 x 2.5" drive bays (dedicated)
  - 6 x 3.5" / 2.5" drive trays with preinstalled silicone grommets
- **Motherboards:**
  - XL-ATX [13.6" x 10.3"
  - (345 mm x 262 mm)], Standard ATX,
  - microATX, Mini-ITX
- **9 expansion slots**
- **Maximum graphics card size:** 13.0" (330 mm)
- **Maximum CPU cooler height:** 6.7" (170 mm)
- **Cooling System:**
  - 2 x 120 mm top TwoCool™ exhaust fans
  - 1 x 120 mm rear TwoCool™ exhaust fan
  - 2 x 120 mm internal intake fans (optional)
  - 2 x 120 mm front intake fans (optional)
  - Fan power hub: allows you to connect four 3-pin fans to a single Molex for improved cable management
- **Dual-layer** 0.8 mm steel / polycarbonate side panels
- **Triple-layer** (aluminum, plastic, foam) front bezel with double-hinged door: opens up to 270°
- **Water cooling support:** rear water cooling grommets
- **Enlarged CPU cutout**
- **Front I/O ports:**
  - 2 x USB 3.0 with internal motherboard connector
  - 2 x USB 2.0
  - Audio In/Out
- **Bottom-mount PSU** with dedicated intake and filter
- **Unit Dimensions:**
  - 526 mm (H) x 231 mm (W) x 562 mm (D)
  - 20.7" (H) x 9.1" (W) x 22.1" (D)

Contact: Altech Computers **Phone:** (02) 8831 9999 **Web:** www.antec.com

WINDOWS

Boost performance with a RAM drive

A RAM drive can add to your PC's performance in everyday operations. Ashton Mills explains how.

APC EXPERT

Ashton Mills has been testing OSs since Slackware came on floppies. Before this he was one of the few who used OS/2 (and loved it) and before that, he remembers installing Windows 3.1 NT from 22 floppy disks. His idea of fun is to spend a weekend compiling the latest Linux kernel or testing out the latest Windows beta.

We've previously covered the benefits of using spare RAM for disk caching, but there's more than one way to put extra RAM to use: it may at first seem counter-intuitive to use RAM drive software to boost system performance – after all, the contents are lost when you shut down – however, it all comes down to how you use it.

THE BENEFITS OF A RAM DRIVE

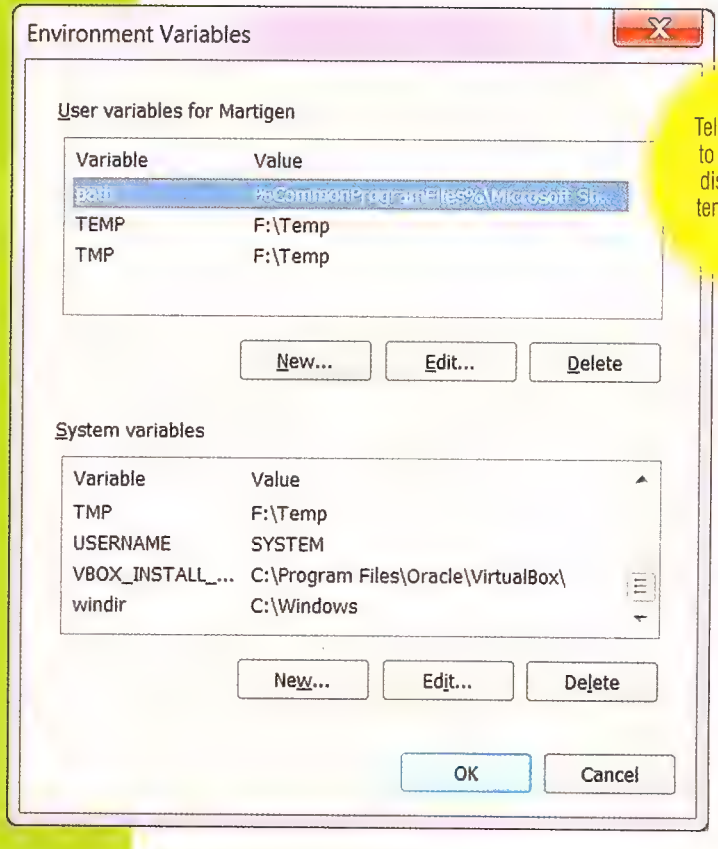
Naturally, a RAM drive gains the key performance metrics of system RAM: very low seek times and very fast transfer rates – faster than any hard drive or SSD can hope to match.

Creating a RAM drive allows you to take advantage of these features for any tasks that might benefit from improved performance. Popular examples include audio, image and video editing software that can use temporary 'scratch space' to accelerate its performance.

But a RAM drive has benefits for home users, too. Used as a cache for your browser it can speed up web surfing and as a location for Windows temp directories, it can speed up file operations like archiving and installing programs. If you make it large enough, you can even run games from it for insanely fast loading times.

It has extra benefits depending on your setup – notebooks, often with slower 5,400rpm drives, can get a nice speed boost. Although they're already very fast, SSDs can benefit by using a RAM drive for temporary file operations (like the browser cache) and spare unnecessary writes, in turn increasing its longevity.

And the fact that data is lost when the power is turned off is often seen as a security benefit: all cached data will be irrevocably cleared, as opposed to deleting on a hard drive where software could still recover fragments of data.



Telling Windows to use the RAM disk for storing temporary data.

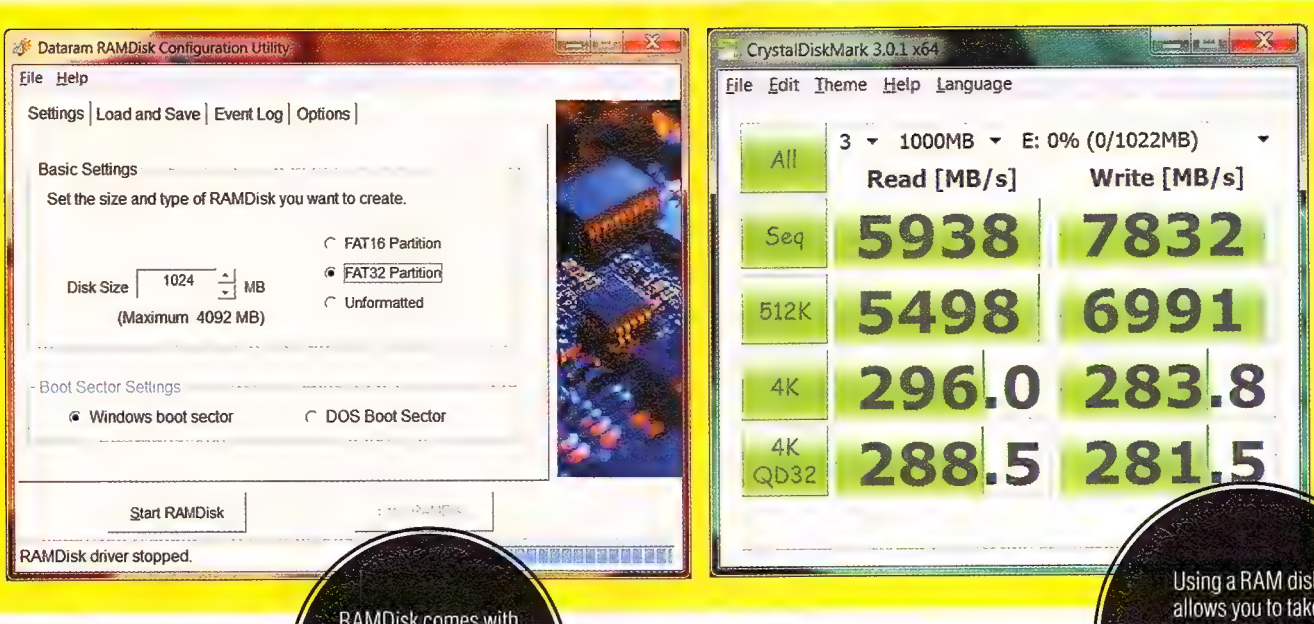
There are lots of RAM drive products available, both free and paid, but we'll focus on just one for this tutorial: RAMDisk. We've chosen this one because it comes with a number of nifty features that make it easy to use, plus it has a free version that limits you to a maximum 4GB drive, which is plenty for most home needs anyway.

Of course, before you begin, you'll have to head to **tinyurl.com/ydb4z49** and download and install the Dataram RAMDisk software.

CONFIGURING RAMDISK

The options are pretty straightforward, but some bear covering in greater detail.

- **Size.** When setting the size of the disk, don't be overzealous. Remember that any RAM you allocate to the RAM disk won't be usable by Windows for programs, so don't make it so large that you cause Windows to use its swap file and thus *slow* down your system. If you have a 4GB system, you won't want to allocate more than 1GB. For 6GB systems and more, a RAM drive that's between 2GB and 4GB will give you more flexibility.
- **Format.** For format type, choose FAT32. You can also leave it unformatted and then format it in Windows as with any other drive (for example, to



RAMDisk comes with some useful features that make it easy to use it to boost system performance.

Using a RAM disk allows you to take advantage of insane speeds and accelerates programs and tasks.

NTFS), but FAT32 is faster than NTFS for smaller volumes and especially for the type of data you're likely to use.

- **Image saving.** Under the 'Load and Save' tab, you'll find one of the more useful features: you can optionally save the contents of the RAM disk to a hard drive at shutdown and have it loaded again at startup. This is useful if you want to use the RAM drive to launch and run programs (including games), and therefore need the data to *persist*. Note that depending on the size of the RAM disk, this may slow down both bootup and shutdown times for Windows as the image is loaded and saved, respectively (though RAMDisk will compress it for you to reduce the impact at bootup).
- **AutoSave:** If you do want to use it as a persistent drive, the 'AutoSave' option will regularly save the image at the specified interval. Note that this interval only triggers if the contents of the RAM drive are modified, which helps to reduce unnecessary hard drive writes.

The uses of a RAM drive are really only limited by (understandably) the size of the drive you create. Using a persistent drive and installing programs to it is easy enough, so we'll show you instead a little more complicated setup to speed up browsing and Windows temp directory usage using a non-persistent drive.

RAMDISK AS A BROWSER & TEMP CACHE

01 Start RAMDisk and set the format to FAT32 and size to 1GB or more, then click 'Start RAMDisk'.

02 When Windows says it's found a new drive, open it in Explorer and create a Cache and Temp directory. Under the Cache directory, create another one for each browser you'll be using (IE, Firefox and so on).

03 In the RAMDisk settings, click the 'Load and Save' tab, and hit the 'Save disk image now' option.

04 Then tick 'Load Disk Image at Startup'. Do *not* tick 'Save image at shutdown', unless you want the contents to be persistent. This way the image you've already saved, an 'empty' RAM disk, is loaded each bootup with your directories already created.

05 Finally, we need to tell any browsers and Windows to use the RAM disk.

- To redirect IE's cache, go to 'Tools > Internet Options'. Then, under 'Browsing History', click 'Settings' followed by 'Move folder' (your RAM drive letter and browser cache directory).
- To redirect the Firefox cache, you need to dig a little deeper. Launch Firefox and in the URL bar, enter about:config . Next, in the search bar, type in cache . If it's not already present, right-click and select 'New > String', and add the following configuration key: browser.cache.disk.parent_directory . For the value of the key, enter the path to the RAM drive and Firefox cache directory you created earlier.
- To redirect Chrome, the easiest method is to edit the Chrome shortcut. Just append the following to the end (after chome.exe): --disk-cache-dir=F:\Cache\Chrome --media-cache-dir=F:\Cache\Chrome , using the path to your RAM drive and cache directory.

1GB is plenty for browser caching, but not so much if you also want Windows to use it as a scratch drive for temporary files. If you create a drive one of at least 2GB or more, you can also do the following:

- Go to the Windows Control Panel and click 'System & Security > System > Advanced system settings' (in the left-hand pane). From here, click the 'Advanced' tab and at the bottom, click 'Environment Variables'. At the top you'll see two variables defined for TEMP and TMP; click on each and then click 'Edit' and type in the path to your Temp folder on your RAM drive.

However, note the following caveat: while you can restrict the cache size for the browsers, you can't do so for the Windows temp directory. If anything should require more space than is available in the Temp directory, the action will likely fail and Windows will report it ran out of disk space. The most likely scenario for this to happen is decompressing large archives of a few GB or more, since Windows writes data temporarily to the Temp directory when it does so.

This aside, using a RAM disk can work well for TEMP because the contents aren't needed once Windows shuts down, and often you'll find the temp directory on your hard disk filled with gunk and taking up disk space that Windows fails to clean out. With a RAM disk, this isn't an issue.

OS CHALLENGE

Tweaking Unity?

Don't like Unity as is? No problem. There are a number of programs you can use to adjust Unity to your liking.

APC EXPERT

Ashton Mills

Ashton Mills has been testing OSs since Slackware came on floppies. Before this he was one of the few who used OS/2 (and loved it) and before that, he remembers installing Windows 3.1 NT from 22 floppy disks. His idea of fun is to spend a weekend compiling the latest Linux kernel or testing out the latest Windows beta.

When Ubuntu's new user interface was first released, it had much of its configurability hidden from the user. Not necessarily by design, but that simply as a new interface, there weren't tools available to dig in and tailor the various settings which determine how Unity behaves.

But that's all changed now and there are a number of useful programs you can use to tailor and tweak Unity to your liking.

MYUNITY

MyUnity is one of the newer and perhaps snazzier tools to tailor Unity. It allows you to tweak the transparency of the Unity dock, icon size, backlight functionality and whether mounted devices are shown. It also provides options for the Dash (including whether it should be sized for desktops or notebooks, and the quality of the background blur), the panel, fonts, themes and finally the desktop itself, such as toggling home, networking, trash and devices icons. It also allows you to set how many virtual desktops are in use, if the standard 2x2 for Ubuntu isn't enough for you.

MyUnity can be found in the Ubuntu repositories. Simply search for MyUnity or run apt-get install myunity from a Terminal.

UNSETTINGS

Unsettings, much like MyUnity, allows you to tweak the size and opacity of the Unity launcher, when mounted devices are displayed and how the backlight for apps operates. However, it also includes the ability to tweak auto-hide functions, how the launcher is triggered, and notification and launch animations. It also features tabs for configuring the dash, panel, fonts, themes and general desktop functionality. Of particular note is the ability to enable or disable Unity-specific features, such as the global menu and overlay scrollbars (previously covered in these pages). While not as aesthetically pleasing as MyUnity, it covers more Unity functions in addition to base GNOME functions to allow you to tailor your Ubuntu desktop to taste.

Unsettings isn't included in the Ubuntu repositories, but it can be installed as follows:

```
sudo add-apt-repository ppa:diesch/testing
sudo apt-get update
sudo apt-get install unsettings
```

UBUNTU TWEAK

Ubuntu Tweak is a popular application for tweaking all manner of settings in Ubuntu. The latest release allows you to play with everything from sounds and fonts to themes and Session Indicators. It now also sports a Unity sub-category that includes the

SETTINGS TO TRY

If you haven't played with tailoring Unity so far, here are some settings to try.

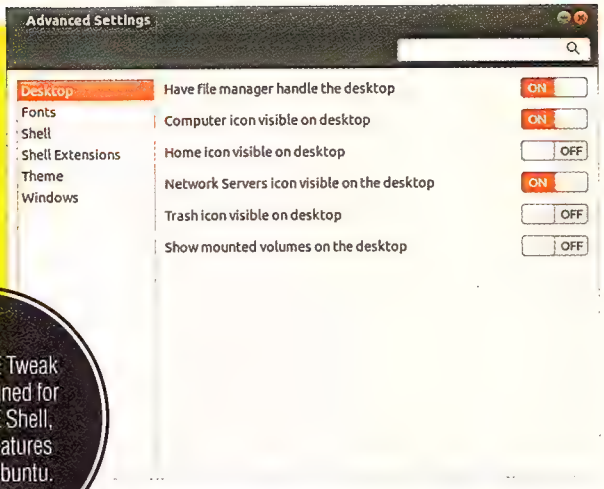
- Reduce the size of the launcher to fit more programs before Unity's layering kicks in.
- Set the backlight to be on only for the active application, making it easier to see which programs are running (helpful when using multiple desktops).
- For the panel, change opacity to 100% — depending on your theme and background, this can create a nice effect.
- For slower computer systems, change the blur for the dash from 'Active' to 'Static'.
- Add shortcuts for networking, home and computer to your desktop to make it easier to access local and networked file systems.
- Increase the number of desktops if you're laying too many programs on your desktops.
- Finally, theme options are quite limited with Unity's own options, but the tools listed here allow you to set GTK, Windows and icon themes. Play around for a new look.

Tweaking the Ubuntu Unity desktop to add some classic shortcuts.

GNOME TWEAK TOOL

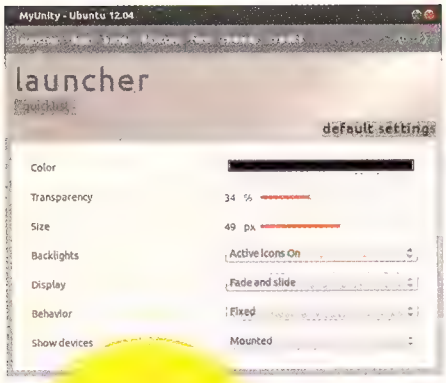
There's another useful tool for configuring settings that comes with GNOME 3.0, upon which Ubuntu 12.04 is based. However, it's more specific to GNOME Shell and GNOME 3.0 than Ubuntu and Unity, but it nonetheless provides a few useful options to tweak, including setting which desktop icons are visible (computer, network, trash and so on), fonts, themes and Window actions. For GNOME Shell it includes a number of options as well as the ability to manage GNOME Shell extensions.

Just note that, given it's primarily designed for GNOME Shell, Ubuntu will prompt you to install 75MB worth of GNOME 3.0 support libraries, which you don't actually need with Precise and Unity in order to use it. However, it's good to have options if you need more than the three main programs presented here.



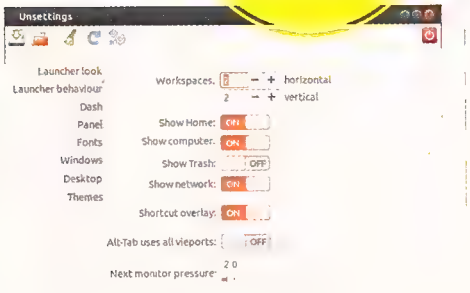
The GNOME Tweak Tool is designed for the GNOME Shell, but some features work with Ubuntu.

THERE ARE A NUMBER OF PROGRAMS YOU CAN USE TO TAILOR UNITY TO YOUR LIKING



As the name implies, MyUnity allows you to tailor Unity more to your own style.

Unsettings isn't pretty, but it has the most Unity-specific features to play with.

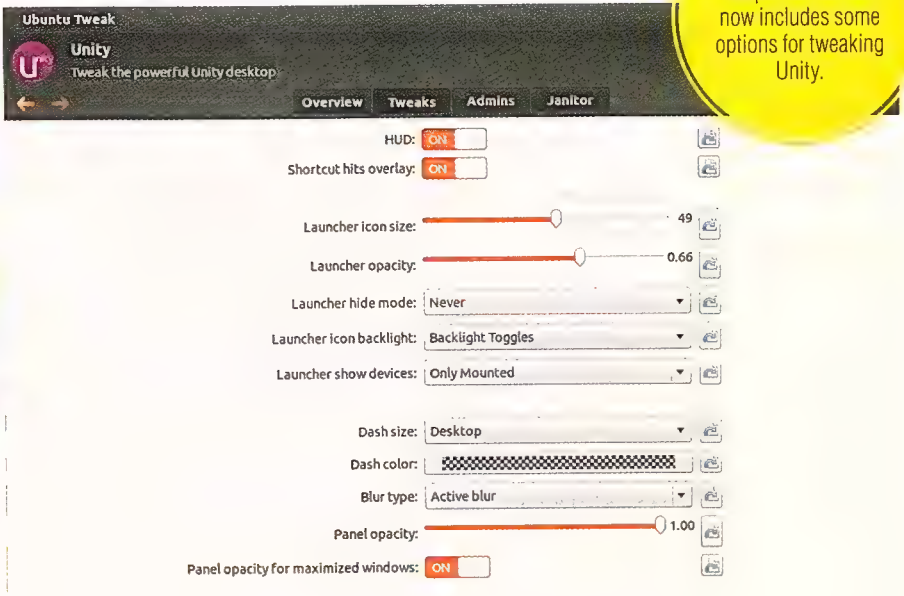


ability to enable or display the new HUD in Precise Pangolin, the shortcut hints overlay, launcher size and opacity, and the backlight and launcher visibility settings. It also includes basic dash configurability allowing you to play with desktop or notebook sizes, colour, blur type and opacity, much like MyUnity provides. On the whole, it doesn't feature quite as many options as Unsettings, although it includes all the essentials.

Ubuntu Tweak is updated regularly, so while you can install a standard .DEB file from **www.ubuntu-tweak.com**, it's easier to add a repository and have it automatically updated with new releases like so:

```
sudo add-apt-repository ppa:tualatrix/ppa
sudo apt-get update
sudo apt-get install ubuntu-tweak
```

Ubuntu Tweak is quite comprehensive and now includes some options for tweaking Unity.



IPHONE

Travelling with your iPhone

Going overseas? Your iPhone can be an invaluable resource for all things travel-related.

APC EXPERT

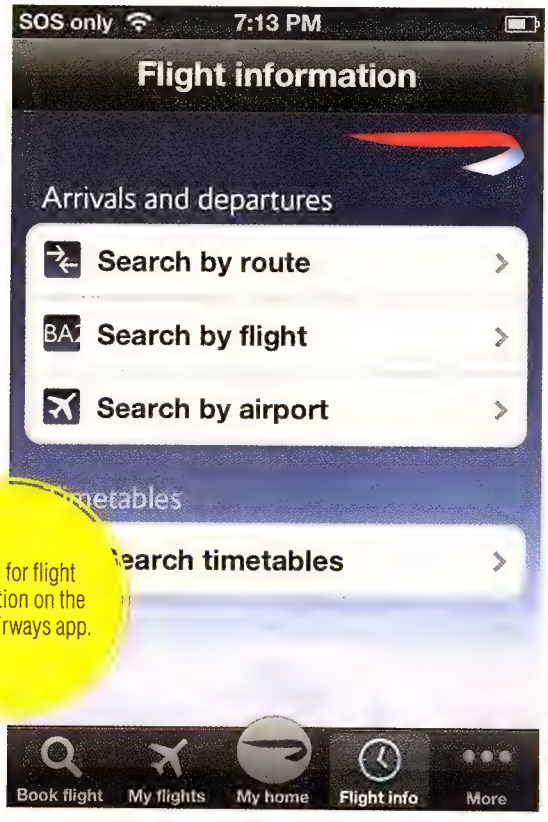
JENNETH CRAFFITI

Jenneth has been writing and obsessing about mobile technology for nearly a decade. Her first i-device was a Compaq iPAQ, and she counts jailbreaking and installing custom ROMs as two of her favourite hobbies.

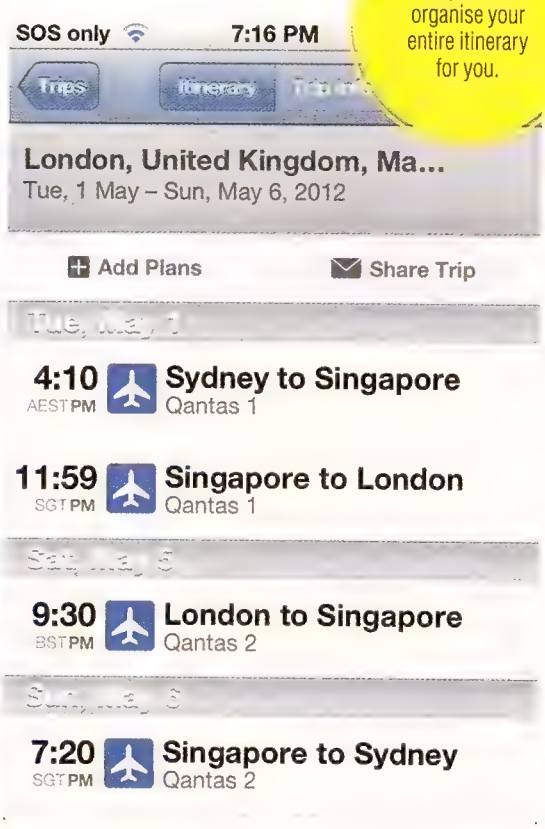
First things first. You'll need to sort out your mobile data for use overseas. Given the exorbitantly high cost of global data roaming, this isn't a feasible option for regular use. You have two options: you can take your existing microSIM out of your iPhone and replace it with a local prepaid SIM in your destination country; or you can take advantage of add-on packs from your carrier that give you an allowance of data for much cheaper than the global roaming per KB rate.

There are pros and cons for either method. The first option gives you the most data and an allowance of local and international calls and texts for an affordable price, enabling you to use your iPhone without having to worry about bill shock when you get home. Most countries offer prepaid microSIMs for travellers. The downside is that people won't be able to reach you on your existing number while you have the prepaid microSIM in your iPhone, and this is the main advantage of the second method, although the add-on packs are for data only.

The prices for global roaming data packs from each of the main Aussie carriers aren't cheap, but they're still far, far better than what you'd otherwise pay. Vodafone offers a range of roaming data bundles for postpaid accounts on a month-to-month basis, from $20 per month for 10MB of data to a whopping $3,300 per month for 2GB of data. Telstra offers international roaming data packs for postpaid and prepaid users with roughly the same prices across both account types, starting at $29 for 10MB. Optus offers a great deal for its personal users on a postpaid account travelling to Singapore, Indonesia, Thailand, Hong Kong, Malaysia, Taiwan, Philippines and South



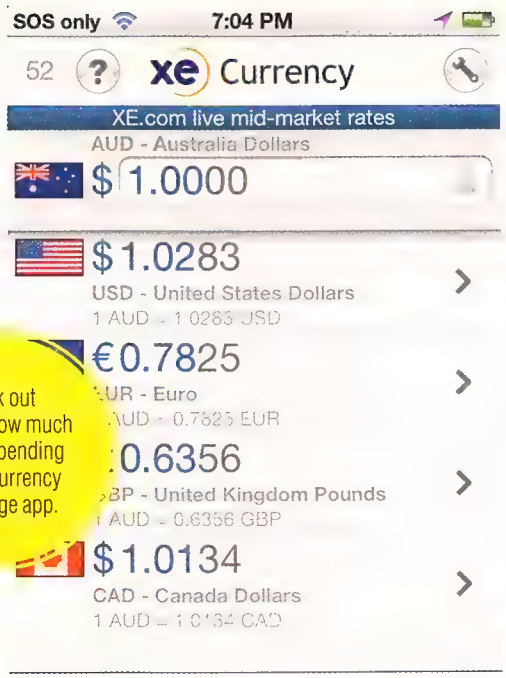
Search for flight information on the British Airways app.



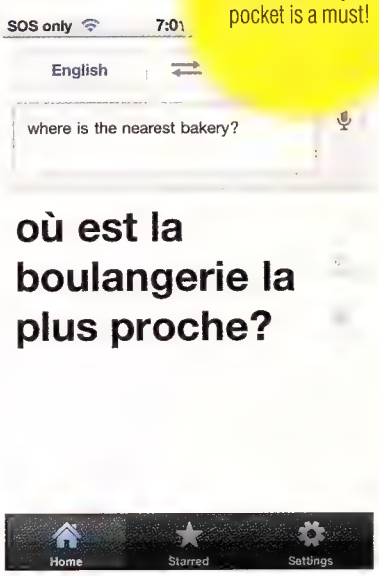
Trip It can organise your entire itinerary for you.

Korea: for $27, you get unlimited data for three days; or for $40, unlimited data for five days. In other countries, the rate is $20 per 10KB, but Optus offers a 20% discount if you connect to particular networks in certain countries like India, Singapore and Thailand.

Once your mobile data is sorted out, it's time to load your iPhone with the apps that will make your trip as smooth and enjoyable as possible. TripIt, a travel itinerary organiser, is a good start. This app makes compiling your itinerary across various service providers (airline, car, hotel, shuttle buses, tours, restaurants, shows and so on) ridiculously easy. For most emails, you don't have to do a thing – it will access your inbox (if you give it permission to), find the relevant confirmation emails and compile your itinerary with all the relevant details in one place. But it doesn't catch everything, and for the ones that slip



Work out exactly how much you're spending with a currency exchange app.



A translator in your pocket is a must!

IPHONE AUDIO WALKING TOURS WORK OUT TO BE CHEAPER THAN HUMAN-OPERATED TOURS

through the cracks, you can forward the confirmation emails to the TripIt email address. The service and app are free, but you can upgrade to the 'no ads' version for $4.49, and there's a TripIt Pro option for $49 a year that monitors your flights for potential airfare savings and sends you status alerts for delays, cancellations or gate changes.

Most of the major airlines also offer their own iPhone apps that do everything from check you in and track your flights to monitor your luggage and help you navigate your way around the airport. The British Airways app, for example, lets you check in, use your iPhone as a boarding pass and view live departure times and gate number information. Surprisingly, Qantas doesn't have an iPhone app for this purpose (Windows Phone is the only platform that Qantas has developed for thus far), but you can sign up to Qantas's SMS update alerts to be notified of any flight changes.

A currency conversion calculator is a must-have any time you're overseas, and the free XE Currency gets our pick as the best one for the iPhone. Currency rates are updated every minute, and it stores the latest rates so you can use it even if you don't have an internet connection. A basic unit converter can also come in handy for countries that don't use the metric system. There isn't much to separate the various unit converter apps that are available on the App Store, but if you want one that includes currency conversion and is easy to use, GlobeConvert is one of the better free apps.

Travelling to a non-English-speaking country? The right app can turn your iPhone into a modern-day Babelfish. The free Google Translate works wonders for translating between English and other languages – it can translate text between 64 languages, translate spoken words and phrases for 17 languages, and use text-to-speech for having translations spoken out loud for 24 languages.

If you're after more of a phrase book, Coolgorilla offers a range of affordable 'talking' phrasebooks with more than 500 phrases split across categories like accommodation, activities, shopping and medical. Lonely Planet also offers a range of talking phrasebooks, with a built-in search function (in addition to navigation by category) to make it easier to find certain words or phrases.

A guidebook app is another useful addition to your iPhone that will help you navigate unknown territories and find the best places to visit, shop, eat and drink at. Frommer's has just released a new range of interactive 'day by day' travel guides for popular destinations like Great Britain, Japan, France and California. The apps aren't cheap, starting at $10.49 each, but they improve on regular 'hard copy' travel guides thanks to the interactive layered maps and itinerary guides, links between related subjects, the ability to call places directly from the app, and built-in search function. It also offers some of the hard copy perks like bookmarking and highlighting.

Another advantage is that its apps are universal, so you only have to pay once to access the same app from your iPhone, iPad and iPod touch. There are many other travel guides worth considering as well – Lonely Planet offers city guides for more destinations than the Frommer's series, and they're cheaper at $6.49 each.

A twist to the traditional travel guide apps are audio walking tours, and these work out to be significantly cheaper than booking a regular 'human-operated' tour. It's worth doing a Google search for iPhone audio tours in your destination city, as different software developers tend to offer tours for particular cities only. Lonely Planet, for example, offers a selection of audio tours in London, while Rick Steves' Audio Europe app lets you download self-guided tours through certain European cities.

IPAD

Turn your iPad into a notebook replacement

A question that's asked by many is whether an iPad can function as a notebook replacement. It can, to a certain degree, but it largely depends on what your needs are.

APC EXPERT

Jenneth has been writing and obsessing about mobile technology for nearly a decade. Her first i-device was a Compaq iPAQ, and she counts jailbreaking and installing custom ROMs as two of her favourite hobbies.

An iPad can function as a notebook replacement for many things, and can do almost everything a full-blown computer can, like web browsing, word processing, multimedia playback, image editing, social networking, email and gaming. At the same time, its capabilities are fairly limited for each type of computing task, and for advanced tasks like video editing, 3D gaming, and complex word processing or spreadsheeting, you're better off with a proper notebook. Also, iOS can't display more than one app at a time, which makes it difficult if you need to view two or more windows side by side on a regular basis.

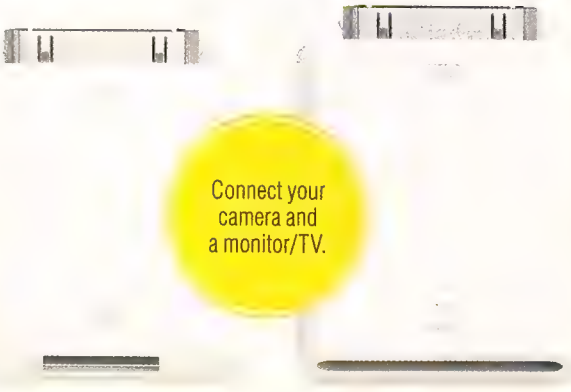
But let's just say your computing needs are fairly modest. The iPad can function as a versatile notebook replacement with the help of some extra hardware and apps. If you need to do a lot of typing, a Bluetooth keyboard is one of the best investments you can make for your iPad. The accessories market is crowded with a wide variety of iPad-compatible Bluetooth keyboards – from ones that are small enough to put in your pocket to full-sized keyboards that you can also use with a Bluetooth-equipped desktop computer. Our favourite is the Logitech Keyboard Case by ZAGG, as the keys have excellent tactile feedback, and it folds up into a compact, transportable package that protects the iPad's screen during travel.

Other accessories that are worthwhile getting include the Apple iPad Camera Connection Kit (for transferring photos from a digital camera or memory card) and the Apple Digital AV Adapter (for connecting the iPad to an HDTV or LCD monitor over an HDMI connection). For times when the iPad's 9.7in screen isn't quite big enough for your needs, the latter accessory in particular comes in handy for blowing up the display to a more comfortable size.

If you have the new iPad or an iPad 2, the Digital AV Adapter can 'mirror' the iPad's display on the external monitor, so that everything you see on the iPad is replicated. If you have an iPad 1, video mirroring isn't supported, but you can use the 'video out' function of core apps like Safari, Photos, and YouTube, as well as a selection of third-party apps that support video out.

And then there are the apps. The rich iPad apps library means you'll be able to find apps to cover anything you can think of – and quite a few for things you haven't thought of yet. The iOS limitation of only being able to display one app/window at a time can be worked around somewhat by using the free Dual Browser app. As the name implies, it lets you view two web pages side by side, but you're not limited to just plain web pages – you can take advantage of web-based apps for email, word processing (Google Docs) and YouTube to use this app for advanced notebook-style multitasking. ETC

The keyboard/ case is handy for heavy typers.



Connect your camera and a monitor/TV.

ANDROID PHONE

Port ROMs to your device

Update your phone's outdated OS to a community ROM like CyanogenMod.

APC EXPERT

SIMON CHESTER

An Android enthusiast since the days of the Dream, Simon has watched the fledgling OS grow from curio to juggernaut, and has rooted, ROMed and tweaked more devices than is polite to speak of. Join him as he shows you how to make the most of that Android powerhouse in your pocket.

If you're rocking an end-of-life handset, or perhaps an el cheapo prepaid Android one, you may be a little disappointed that you're on an outdated version of the world's best phone OS. Worse yet, there may be minimal support in terms of community ROMs.

Thankfully, it's possible to port CyanogenMod – or just about any other community ROM – over to your beloved – if unpopular – handset, with just a little copy/paste mojo. First, find out what type of CPU your phone has (visit **tinyurl.com/6qrpk5p**) and find a ROM that's designed for the same CPU type and phone manufacturer. Any stock Gingerbread, ICS, or CyanogenMod 7/9 ROM should work, but you'll have to make sure your phone can handle the ROM – no ICS for an HTC Hero, for example.

You'll need: Notepad++, a compression program, the ROM you want to port to your phone (let's call it the 'base'), as well as a ROM designed for your phone (let's call it 'stock' even though it may be a custom ROM). This guide may mention files or directories that aren't present in your ROM; don't worry, just carry on.

On your PC, extract the .ZIP files containing the two ROMs, and navigate to /system/app in your extracted base ROM and copy stk.apk, vpnservices.apk, camera.apk and bluetooth.apk into a temporary directory somewhere else on your PC. Now, delete the following folders from your base ROM and replace them with those from your stock ROM: /data, /system/app, /system/framework, /system/fonts and /system/media.

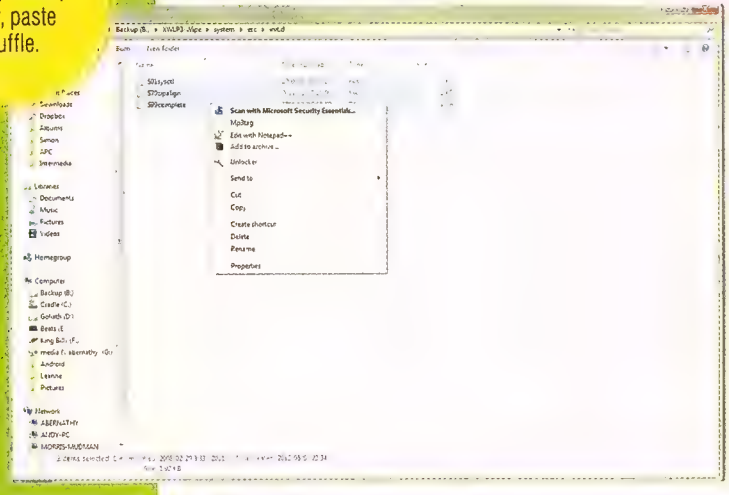
From your stock ROM, copy /system/lib/libandroid_runtime.so to the system/lib/ directory of your base ROM, overwriting the file. Next up, move the .APKs you copied earlier back into the /system/app directory of your base ROM. Open up /system/lib in your base ROM and copy all the files and folders. Paste them into the stock's /system/lib directory, replacing all. Then go back to the base ROM and delete the /system/lib folder, and replace it with the /system/lib folder from the stock ROM. Next, navigate to the /system/etc/init.d folder in the base ROM and do the same copy-from-base, paste-to-stock, delete-from-base, copy-from-stock, paste-to-base shuffle as before.

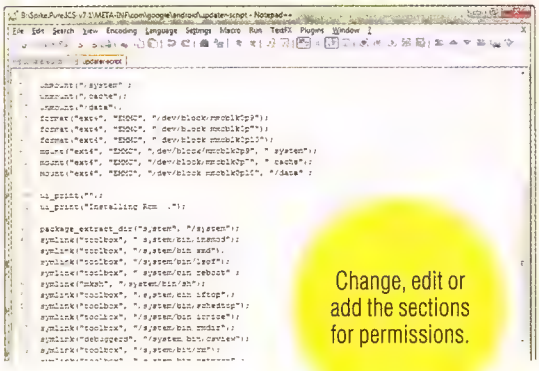
Sick of copying? Tough. Navigate to /system/etc/permissions and do that same copy-paste dance one more time. Now, open system/build.prop from both the stock and the base ROM in Notepad++. Update the stock build.prop to match the values for 'ro.build.description=' and 'ro.build.fingerprint=' from your base. Now save the stock build.prop, exit Notepad++, and copy the stock build.prop into the base ROM, overwriting the base build.prop.

Almost there! In Notepad++, open \META-INF\com\google\android\updater-script from both your base and stock ROMs. Edit the base's script to be like the stock's updater-script: specifically, change, edit or add the sections for permissions, ui_prints, asserts, run_programs and installing the kernel. Don't change any of the symlinks. In the base script, make sure the 'format' values are appropriate for your device (compare them to the stock script). Finally, make sure your kernel is specifically for your device.

Now you can update any apps you require, or add any tools like BusyBox or SuperSU. And that's it! Your base ROM is now ready to be zipped and installed on your device via Clockwork Mod! APC

Do the copy, paste, delete, copy, paste shuffle.





Change, edit or add the sections for permissions.

ANDROID TABLET

Enable gestures

If you've rooted your tablet (please tell me you have), there's an easy way to assign common tasks to simple gestures.

APC EXPERT

SIMON CHESTER

An Android enthusiast since the days of the Dream, Simon has watched the fledgling OS grow from curio to juggernaut, and has rooted, ROMed and tweaked more devices than is polite to speak of. Join him as he shows you how to make the most of that Android powerhouse in your pocket.

When you hold 10 inches of touch-sensitive glass in your hand, it does seem a little unnecessary to have to open and navigate through a menu, just to activate something that should be but a simple swipe away. This is one of the occasions where Apple got something right. However, pinching to go home is but the beginning of your new gesture-based experience.

First up, glide your way over to the Play Store and download the free version of Gesture Control (known as Gesture Control Lite). This will allow you to make sure that it works on your tablet. If it works, the bad news is that the full version of the app does run at a rather high $4.86 (at the time of writing), but the good news is that the full version of the app does run.

The app is fairly simple to use, but there are a few things that could possibly go wrong. As mentioned, you need a rooted Honeycomb or Ice Cream Sandwich tablet (or handset), with a recent version of BusyBox (chances are that your rooted ROM already includes it, but if not, search for BusyBox on the Play Store), and, if you're running ICS, it's recommended that you use SuperSU, rather than Superuser. Again, this is installable from the Play Store.

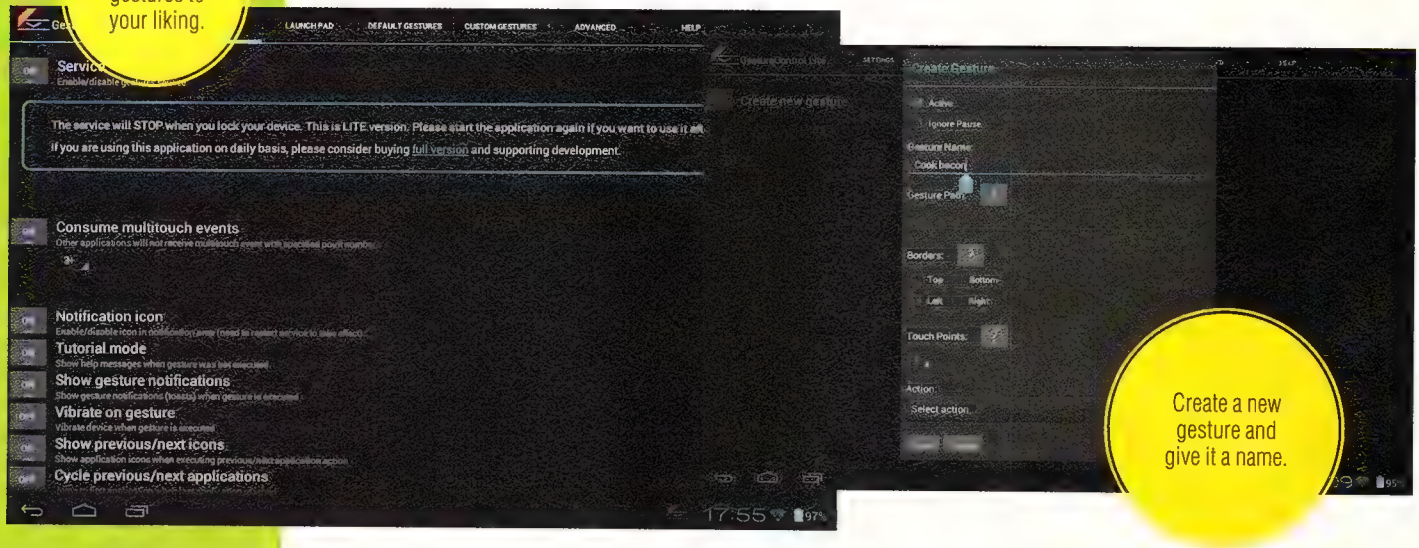
All done? Installed? Ready? Good. Now for the exciting part – enabling gestures on your tablet is as simple as running the app.

As standard, the app enables a two-finger downward swipe as 'back'; a two-finger upward swipe to show/hide the status bar (full-screen games FTW!); a four-finger swipe left/right to switch to the previous/next application; Apple's very own four-finger pinch to go home; and a four-finger expansion (anti-pinch?) will open 'LaunchPad', which gives you access to a list of your favourite applications, selectable from the 'LaunchPad' tab in the app itself.

You can change any of the existing gestures, or create your own custom gesture, with any gesture that allows you – in addition to the above functions – to start an application; kill the current application; open the recent application dialog/list; activate the 'Menu' button; open the notification drawer; start a launcher shortcut (bookmark, contacts, settings, and so on); go forward in the browser; play/pause/previous/next media; start a Tasker task; pause gestures; exit gesture control, or turn the screen off/lock the device.

To change the existing gestures to your own, simply open the 'Custom Gestures' tab and touch the 'Create new gesture' button. The gestures are specified in terms of the number of fingers used, and can consist of any combination of left, right, up, down, and diagonals.

As with any hack like this, it may not work perfectly out of the box. However, there are troubleshooting options available under the 'Advanced' tab. For a run-down of common issues, as well as the best way to contact support, be sure to visit the official support thread at **tinyurl.com/7u4kytb**.


Custómise gestures to your liking.
LAUNCH PAD
DEFAULT GESTURES
CUSTOM GESTURES
ADVANCED
HELP
The service will STOP when you lock your device. This is LITE version. Please start the application again if you want to use it all.
If you are using this application on daily basis, please consider buying full version and supporting development.
Consume multitouch events
Notification icon
Tutorial mode
Show gesture notifications
Vibrate on gesture
Show previous/next icons
Cycle previous/next applications
Create new gesture
Active
Ignore Pause
Gesture Name:
Gesture Pad:
Borders:
Touch Points:
Action:
Select action...
Create a new gesture and give it a name.

WINDOWS

Build a low-power server

Power to the little people — an old notebook has many uses, including making a great server.

YOU'LL NEED THIS

NOTEBOOK

Even the oldest notebook will retain enough CPU power to function as a basic file server. If you want a box to back up and download files, that old notebook gathering dust in the spare room will be good enough and it won't even use much power.

LINUX

Another issue is that it's likely you'll need or want to reinstall the OS. As this is a server, you don't need Windows; in fact, the old spec would rule out Vista, Windows 7 or Home Server, so Linux it is.

Before it turned into a piece of tech junk, your old notebook was the apple of your eye. But despite now passing out of favour for whatever new-fangled machine has replaced it, your old notebook can be put to good use.

We've looked at using an old notebook in many ways, but here we're going to show you how to use it in a practical and (for once) non-destructive manner. The concept is simple: if you need a basic file server to store, download, back up and generally serve files, then a notebook can do just that with the added bonus of a low-power profile to boot.

The problem is that notebooks are hardly renowned for copious storage space. Notebooks come with a single drive and the obvious first step is to upgrade that. The Thai floods of 2011 sent the price of 3.5in drives skyrocketing; 2.5in drives were also affected, but lower demand meant the rise took longer to kick in. Prices should be dropping again by the time you read this, but depending on the drive installed, you may or may not want to upgrade.

As it stands, both PATA and SATA drives of 160GB-1,000GB can be picked up, with the best-value option slap in the middle at 500GB. These should be around $70 or less soon – a more sensible price for this type of low-rent project than the current $100. We detail the intricacies of replacing a PATA drive next in the first walkthrough.

HIGH SPEED

For servers, we suggest a wired connection to eliminate wireless dropouts. For wireless options, carefully check the signal levels to maximise throughput.

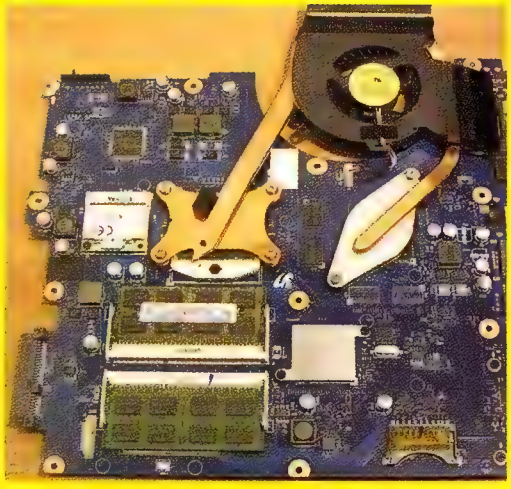
EXPANSIVE EXPANSION

So far we've slightly increased the storage of our servetop... er, lapserve creation, but it's hardly pushing the boundaries. Another obvious expansion point for storage is if the notebook has an optical drive. These can easily be removed and, using the right connections, it's possible to add another hard drive via its

PULL ME APART

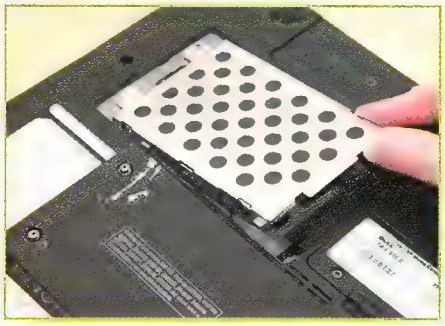
To really expand a notebook, you need to start adding storage in ways that the notebook simply wasn't designed for, via add-on cards. This itself isn't an issue because with a PCI-E-based system, it's simply extending the serial bus and there's very little latency or overhead. The big issue is dealing with the physical housing and power supply for these disparate parts.

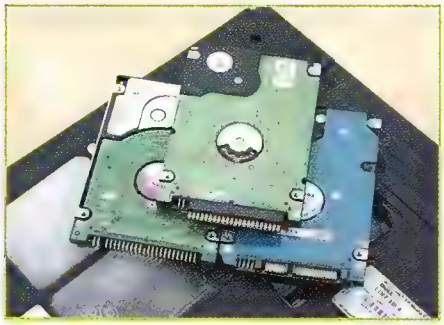
While we want to keep the notebook intact, there's a good argument for stripping it down to just its bare motherboard and mounting it in some type of slimline case. If you use a spare PSU, it's possible to power it on by connecting pins 14 and 15, the green PS_ON and any black COM wire with a paperclip and using this to power the hard drives. You'll still need to use the notebook's own PSU, but this would create a self-contained solution.

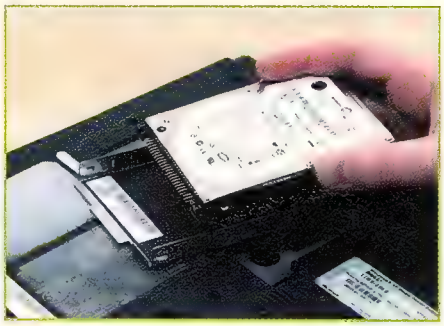


UPGRADE YOUR NOTEBOOK STORAGE

Fancy serving more than two files? Best get more storage.







1 PARALLEL KILLER

Before getting a new drive, you need to know if you have a PATA or SATA unit. Rather than sifting through the specs or the Device Manager, just remove the drive. Almost all notebooks have a maintenance cover marked with a drum. Unscrew this and carefully lever out the drive.

2 CADDY PATA

Once the drive is out, it should be obvious if you're dealing with a PATA or SATA device. Besides the telltale multipin PATA interface versus the edge-type SATA style, most PATA drives use a caddy system to ensure the pins line up correctly. Some may also include an adapter.

3 SATA PATA

Any caddy or adapter will need to be transferred across to your new, bigger, better and faster drive. These should use standard crosshead screws, but some evil companies may have moved on to Torx screws. Transfer them and carefully slot the drive back into the notebook.

connections. The issue is that slimline notebook optical drives use an alternative edge connector, plus there are the physical mounting issues. Jump on eBay and search for optical bay hard drive caddy , which usually sell for around $30. There are models for PATA to SATA, SATA to SATA and SATA to PATA, while the caddies come in 12.7mm and super-slim 9.5mm, so check the exact size and type you need, and also what you're about to buy.

At this level it's not outrageous to think you could have 1TB of storage and for the low-power aims of the project, that could well be enough for most people. However, what if you want more? We can certainly help there, but the solution becomes less tidy and compact, unless you're willing to explore some even deeper do-it-yourself deconstruction, which we look at in 'Pull me apart'.

The issue with notebooks is the spirit is willing, but the flesh is weak. While they have the built-in abilities to support more than one hard drive, they unfortunately don't have the built-in ports. The simple solution is to provide them with the ports and a way to connect those extra drives. Adding them can be extremely simple, as both PC Cards and ExpressCards have twin-port SATA/eSATA adapters readily available for around $30.

If for some reason the notebook is missing these usually ubiquitous expansion slots and you're happy to get a little DIY to locate an internal mini PCI-E port, then twin-port SATA mini PCI-E cards are available at around $80. Ports can be easier to locate than you might at first think, as removing an existing Bluetooth or Wi-Fi adapter will free up a slot.

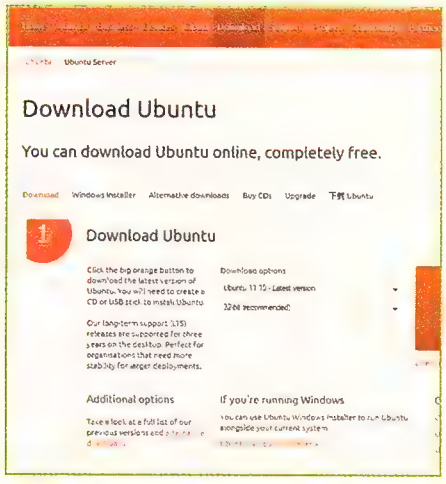
The more quick-witted among you will have already spotted that there's no power for these drives and this is the final problem. The most obvious solution is to pick up an external single-, twin- or quad-bay hard drive docking station. Single-bay units are $20-$130 for a quad-bay unit, which will connect via eSATA to SATA cables. Another option is to find a specialist retailer that can supply dedicated multidrive enclosures, with power and multilink connection solutions.

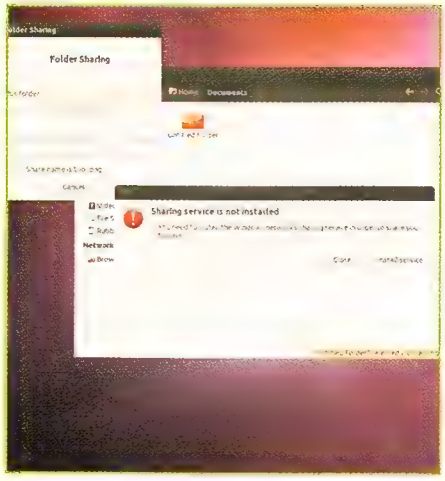
ADD SERVER SOFTWARE

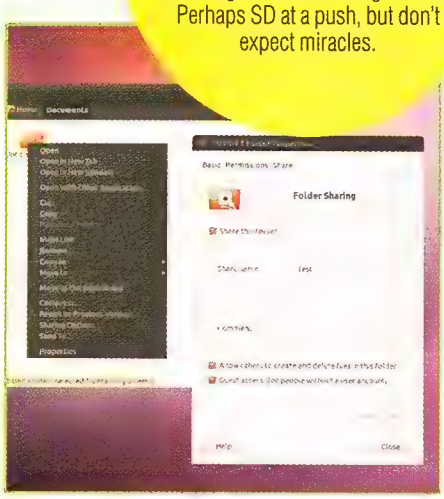
We choose you, Ubuntu, because you're free.

NO TRANSCODING

If you're using an old notebook, it's highly unlikely it'll have enough puff to manage the transcoding of video. Perhaps SD at a push, but don't expect miracles.







1 GET INSTALLED

Head to the Ubuntu web site at **www.ubuntu.com/download** and click 'Download'. We're sticking with the desktop version so as to eliminate issues regarding learning to use the software — it's painful enough to set up with a GUI. The web site also provides easy solutions for installation from CD and USB. Either way, get Ubuntu installed on your server.

2 SHARE & SHARE

The first step is to get a Windows share running so you can copy files to and fro. Linux is rubbish, so this all has to be done by hand. From the launcher, select 'Home > Documents', create a new folder and right-click it. Select 'Sharing Options > Share this folder > Install Service' and that will install the Samba components.

3 SAMBA THE NIGHT AWAY

Samba is the Linux package that handles network sharing between Windows and Linux. The server and folder will appear in the network as a system and shared folder. Right-click the folder and select 'Properties > Share and Permissions' to adjust access rights. Use 'System Settings' to create extra users and adjust access rights for each.

4 EYE TUNES FOR ALL

Select the 'Software Centre', search for iTunes and install 'Tangerine Music Sharing'. Select the 'Dash Home' icon, search for Tangerine and run it. Choose 'Enable music sharing', give it a suitable name, select a folder and add a user limit or password if you need to. That's it. You now have an iTunes server up and running to which most networked audio devices will connect to.

5 MEDIA SERVICE

You'd probably like a UPnP, DLNA-compliant media streaming service. No problem. Select 'Software Centre', search for MediaTomb and install. To configure it select 'Dash Home > Media Apps' and run 'MediaTomb'. If the UI is disabled, open the Terminal, type sudo gedit /etc/mediatomb/config.xml and near the start, change the 'UI' setting from 'NO' to 'YES' and reboot.

6 MORE DRIVES

We've mentioned various ways to expand your notebook server, but how do you add these drives within Linux? Select 'Dash Home > More Apps > All installed' and run 'Disk Utility'. It's the standard partition tool for Ubuntu and does a good job of showing connected controllers and their associated drives. New volumes will need to be formatted in the Ext4 file system and mounted.

LOW POWER TO THE PEOPLE

So what did we achieve? Depending on the model of notebook you have to play with, you'll have a basic file server up and running that draws around half the power, which even a standard server box could achieve.

When we've built systems around desktop processors, a 60W+ power draw is standard. Even this old less efficient notebook will idle along at the mid-teens wattage with the screen off. More up-to-date systems could drop to single-figure levels. In the world of NAS and server boxes, this is very respectable.

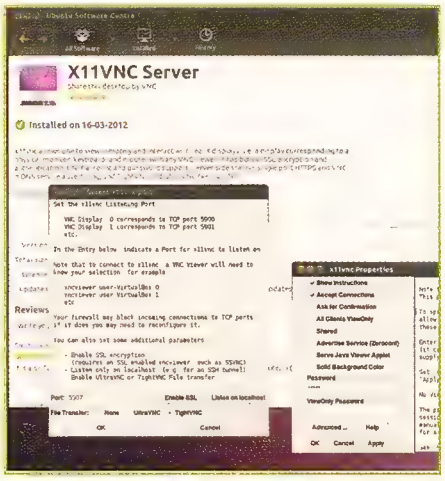
However, a notebook has the advantage of being very compact, which means it's perfect for stashing away in a bookcase, under a coffee table or in any spare nook. Even with the drive bay expansion idea it's not going to require much more space, while the ability to use longish lengths of eSATA cables at least provides a level of flexibility. The only remaining issue is network connectivity. Ideally, we'd recommend a wired option, but that requires the notebook to be placed relatively close to the router. Most notebooks made in the last decade should provide a wireless connection, even a terribly insecure 802.11b could just get by, but we wouldn't consider anything less than 802.11n these days.

Lastly, we'd attempt to get you to save even more power by making sure you implement power-saving modes, such as spinning down drives and even enabling sleep modes, as you can then potentially use Wake on LAN to remotely revive your server, assuming everything is pointing in the right direction. All that's left is for you to enjoy your low-power server and those extra dollars!

THE CLASSIC REMOTE DESKTOP

VNC has been dispensing remote desktop access since 1866.

VNC Viewer for iOS
New features include
• Multitasking
• Full screen display
• Supports Apple TV
• iOS 5 compatible
App Store
RealVNC provides remote control software which lets you see and interact with desktop applications across any network
Latest news



1 LINUX & WINDOWS

No matter what server you're running, for ease of use you need to add remote desktop action to your server. At least using a notebook it has a screen attached, but if you can control it via your main computer, tablet or smartphone, it makes life that much easier. Even better, VNC works with many versions of Linux, Mac and Windows, so all bases are covered at **vnc.com**.

2 GO GET IT

First, you'll need to launch the Ubuntu Software Centre, search for VNC and then install the 'X11VNC Server'. Add the software to the Launch Bar and run it, making sure you choose 'TightVNC'. We had to click 'OK' and run the software again to get the 'Properties'. Select 'Accept Connections' and add a password. You're now done and ready to go.

3 DETAILS & GO

You'll want the IP address of the server. The easiest way is to select the top-right up/down arrow icon and choose 'Connection Information'. The new window will show the 'IPv4 IP Address', so make a note. On your tablet or desktop system, install TightVNC Viewer or any VNC viewer. Use the IP address as the 'TightVNC Server' and click 'Connect with default options'.

4 WE'RE IN!

With firewalls, routers and wireless base stations all behaving, this should connect your Windows desktop, Mac notebook or Android tablet to the server so you can have simple remote access from all your devices. You may want to ramp down the server resolution to 800 x 600 for better phone-based access, so the screen won't need to be scaled.

HARDWARE

How to hack Wi-Fi

Jon Thompson shows why you must never protect your wireless network with WEP.

YOU'LL NEED THIS

BackTrack
The live, bootable, security-based Linux distribution can be downloaded from **www.backtrack-linux.org/downloads**.

WARNING
Hacking your own Wi-Fi network is OK. Hacking others' is not. If you hack a Wi-Fi network belonging to someone else, you're breaking the law and could face a fine. *APC* does not condone hacking.

Think you're secure with basic WEP? You're not. We're going to demonstrate exactly why you need to tighten up your Wi-Fi security by showing you how easy it is to hack a relatively unprotected network. We'll give a working demonstration of the weaknesses in your network's security and how they can be exploited. It's the best way of creating the incentive to shore up that security by using tougher encryption.

In this case, we're going to crack wide open the WEP security that far too many home users still rely on. Whether this is through a lack of knowledge or the belief that they have no assets worth stealing is neither here nor there. WEP is insecure, as we'll show you.

Before we begin, however, we have to make it absolutely clear that this is not a technique you should try in the wild. Doing so is illegal and we don't condone hacking of any kind. The tools we will be demonstrating aren't toys and can wreak havoc in the wrong hands.

RESOURCES

Download the latest BackTrack ISO from **www.backtrack-linux.org/downloads**. If you don't have an ISO burner utility, try ImgBurn from **www.imgburn.com**. To see who made a device you can see in the neighbourhood, go to **www.macvendorlookup.com**. The Windows version of the nmap network scanner can be found at **nmap.org/zenmap**. Further information and full documentation about aircrack-ng and its utilities is at **www.aircrack-ng.org**.

BACKTRACKING

For this demonstration, we're going to use some of the tools that come bundled with the Swiss Army Knife of online security: BackTrack Linux.

This contains all the security tools that the network security professional and hardened hacker alike need to carry out a completely exhaustive examination of a network. Everything we need is installed, configured and ready to go. Being Linux, it's also open source and therefore free to download.

The developers have just released a new version called BackTrack 5.2. You can download the .ISO file at **www.backtrack-linux.org/downloads**. It's designed to run from the DVD drive as a live CD, so copy it to a fresh DVD using your favourite ISO burner. If you don't have one, you can download and install ImgBurn free from **www.imgburn.com**.

After creating the BackTrack DVD, boot it from a computer with a wireless networking card. When

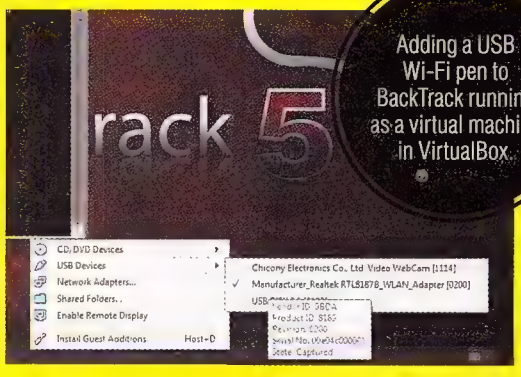
RUN BACKTRACK VIRTUALLY

If you only have one computer and want to run BackTrack as a virtual machine in a free virtualisation suite like VirtualBox (**www.virtualbox.org**), you'll run into problems because of the way the network connection is virtualised. This is because it always appears to be a wired connection. Without a wlan0 adapter, BackTrack will fail to see any wireless packets — but all is not lost.

If you have a USB Wi-Fi network pen, you can make it available to the running BackTrack machine. First, insert it into a convenient slot, wait for Windows to recognise it and if necessary, download and install the correct driver.

Run VirtualBox and start the BackTrack virtual machine. Once booted up and logged in (username: root, password: toor), go to the window in which the machine is running, click 'Devices USB Devices' and select the Wi-Fi pen. If you're in full-screen mode, the 'Devices' menu can be found by pointing the mouse off the bottom of the screen in the middle.

Open a terminal in BackTrack and enter the command **iwconfig** to have Linux re-poll its attached devices.



Adding a USB Wi-Fi pen to BackTrack running as a virtual machine in VirtualBox.

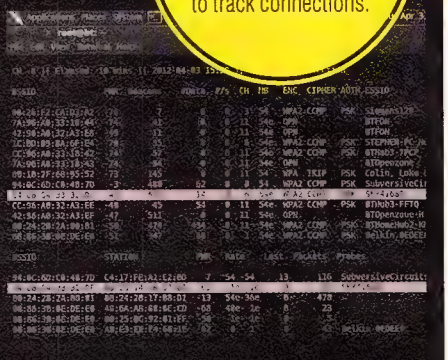
After a minute or so, you should be rewarded with a list of network cards including 'lo', 'eth0' and 'wlan0'. If you get a VirtualBox error when selecting the device, unplug it, plug it back in and then use the 'Safely remove hardware' icon in the Windows system tray to eject it before trying again to add it to BackTrack.

HIDDEN NETWORKS

If you hide your network name (normally called the SSID), airodump-ng can still uncover your network and the computers communicating with it. Run the **airmon-ng start wlan0** command, then set the **airodumpng mon0** command running. If you see any networks with <length: n> in the ESSID column, where n is a number, these are networks where the owner has chosen not to broadcast their name to the world. This name is usually referred to simply as the SSID in most wireless router management console pages. It's called the ESSID in airodump-ng.

In Windows, this ploy makes the network invisible to casual observers, but not to the BackTrack utilities. Packets are still being broadcast containing the BSSID of the network, and any connecting computers will have to include both this and their own MAC address so that the wireless network can correctly route traffic to them.

It's often interesting to watch the connections flying about the neighbourhood to see who's connecting to what. It's possible to see who's at home and surfing the web. If someone has tried to connect to another network recently, the 'Probe' column in the connections list at the bottom of airodump-ng's output will usually list these. The output order can change and be confusing, so here's a tip: press Tab, then use the up and down keys to highlight a network. The connections will also be highlighted in the stations list.



Highlighting networks in airomon-ng using the up and down keys makes it much easier to track connections.

the Boot: prompt appears, press Enter. Select the default text-only version from the bootup menu and when it finishes booting, you should be met with a # prompt and a cursor. Type the word startx and press Enter to load the graphical desktop.

At the top of the screen you'll see a menu bar with a picture of a terminal. Click this and a terminal window will appear. Enter the command iwconfig and a list of network interfaces will appear. One of these should be called wlan0. This indicates that the wireless drivers supplied with BackTrack can see your wireless network card.

The utilities we'll use are all compatible with several industry-standard Wi-Fi chipsets; namely, rtl8187, rt2570 and rt73. This means just about all modern wireless cards should be OK to use. However, if wlan0 doesn't show up, you could try booting BackTrack on a different computer instead. Otherwise, borrow a USB Wi-Fi dongle to see if BackTrack recognises it.

COLLECTING DATA

The standard advice is never to use WEP to secure a Wi-Fi network, but why is this? Put simply, it's because when given enough packets to analyse, cracking software can recover the password (called a passphrase in Wi-Fi speak) to join such a network, as we'll now demonstrate.

Any hacker worth their salt begins by passively collecting data about potential targets and this is exactly how we'll begin. In a terminal window, enter the command airmonng start wlan0 . This command will begin collecting data about nearby wireless networks and send it to a special dump where other programs can pick it up and use it.

When you type in the command, you may get a warning about DHCP. Ignore this and look instead for the message 'Monitor mode enabled on mon0', which indicates that everything is running as it should be in the background. We'll now find out what's being recorded to this mysterious mon0 by entering the command airodump-ng mon0 .

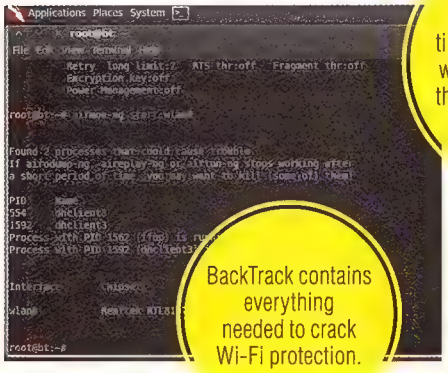
The screen will begin to fill with a list of networks. The 'BSSID' (basic service set identification) column contains the globally unique hardware MAC address of each router or base station within range.

The 'ESSID' (extended service set identification) column is the given, friendly name of each of the networks.

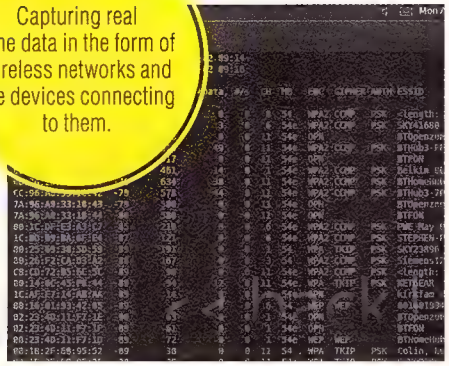
Below this is a shorter list of connections being made to those networks by individual computers. The networks to which they're connecting are displayed in the 'BSSIC' column, and the MAC addresses are also displayed in the 'Station' column. Usefully, the 'Probe' column gives the name of the network currently being accessed.

If you live in an area with lots of Wi-Fi networks and plenty of activity, both lists will expand and contract often, making them difficult to read. To prevent this, with the terminal selected, press the R key twice. This switches off the auto sort facility. Pressing R again will switch it back on. You can also cycle through the columns and have the program sort by these using the S key.

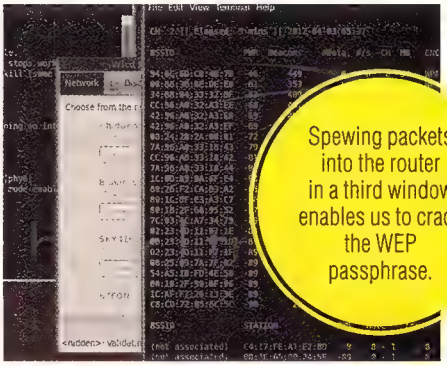
To stand any chance of gaining access to a WEP network, there must be a current connection to it. On the basis that you're cracking your own network, connect a computer to it and it will appear as a station in the lower portion of aidodump-ng's



BackTrack contains everything needed to crack Wi-Fi protection.



Capturing real time data in the form of wireless networks and the devices connecting to them.



Spewing packets into the router in a third window enables us to crack the WEP passphrase.

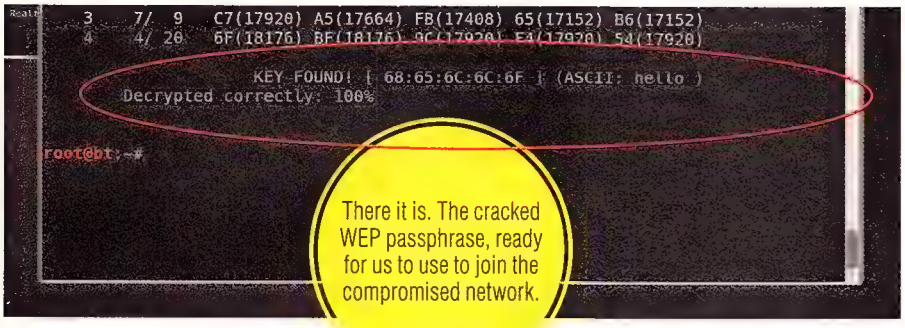
NETWORK MAPPING

Using airodump-ng's output, it's possible to discover what devices people have connected to their networks at any time. This is because every connected device has a globally unique MAC address and the first three fields define the manufacturer code.

For instance, if you see a network with an ESSID beginning with OptusHub, you know that its owners are probably with Optus. But if you notice a connection from another device, you can go to **www.macvendorlookup.com** and enter the first few digits of the MAC address. Suddenly the manufacturer pops out. A vendor of Netgear might suggest that the network's owner is using a Wi-Fi network extender.

Smartphones and other mobile devices also connect to local Wi-Fi networks and hotspots, and will show up in airodump-ng because they use the same protocols to communicate with the networks as any other computing device. Because people rarely allow their smartphones to leave their side, this can be a useful measure of whether a neighbour is at home.

There's a more serious use, though. If you know the family is away and yet a smartphone is trying to connect with their Wi-Fi network, it may be that intruders have broken in. Record the MAC address and if a burglary is reported, you can supply the details to the police.


3 7/ 9 C7(17920) A5(17664) FB(17408) 65(17152) B6(17152)
4 4/ 20 6F(18176) BF(18176) 9C(17920) E4(17920) 5d(17920)
KEY FOUND! [68:65:6C:6C:6F] (ASCII: hello)
Decrypted correctly: 100%
root@bt:~#
There it is. The cracked WEP passphrase, ready for us to use to join the compromised network.

output. Make a note of the station MAC address. Leave the utility running for a few minutes until all networks within range are recorded and then press Ctrl+C to stop the program.

HOMING IN

Next, we need to collect data running between just the router in question and the computer connected to it. To do so, we rerun airodump-ng, but with some filtering switches in place: airodumpng -c <channel> -w <output> --bssid <MAC> mon0 .

Here, <channel> is the channel number of the router in question and <output> is a filename in which to store the captured packets (use dump or something similar for the name). <MAC> is the MAC address of the router.

By running this command, you only see your router and the computer connecting to it. The collected data is also captured in the dump file. As the command runs, pay special attention to the '#Data' column in the top of airodump-ng's output. These are the actual packets going between the computer and the router, and they contain the WEP passphrase. The problem is we need between 5,000 and 25,000 packets to crack the passphrase.

We need to generate a large number of packets and BackTrack contains another utility that will do this for us. Enter the following command, where <BSSID> is the MAC address of the router and <STATION> is the MAC address of the computer connected to it: #aireplay-ng --arpreplay -b <BSSID> -h <STATION> mon0 .

Note the double-dash before arpreplay . Aireplay-ng generates packets that are faked to seem to have come from a particular computer and spewed to the router. You define the MAC address of the source PC with the -h switch. In this case, it's the computer connected to the router.

Every packet sent from the router contains an encrypted version of the WEP passphrase. The reason for generating lots of extra packets is that with a large enough sample of encrypted passphrases, we can use another utility to analyse the captured data and start to make a statistical guess at what the underlying plain text might be.

Aireplay-ng might be slow to get going, but after a few minutes it will suddenly begin generating plenty of extra traffic. Let it keep on going until airodump-ng shows something over about 5,000 in the '#Data' column, after which time you can stop it using Ctrl+C. You can also stop the arpdump-ng command at this point. It doesn't matter if you massively exceed the number of packets. In fact, more data makes it easier to crack the passphrase.

Note that while you're generating these packets, the WLAN light on the router should usually be flashing to say that data is being sent and received. As the associated internet light isn't also flashing to signal through traffic, the target of the packets must be the router itself. This serves as a quick method of telling if someone is attempting this kind of attack against your own network, even (or rather, especially) when none of your own computers are connected at the time.

GETTING IN

With the results of bombarding the router with packets containing the encrypted WEP passphrase stored in a temporary file, we can finally attempt to crack it. To do so, we use the aircrack-ng utility. There's no guarantee that this will work the first time, but if it fails, you just need to collect more than the previous 5,000 or so packets. To run it, enter the following command: #aircrack-ng -z -b <BSSID> dump*.cap .

Again, <BSSID> is the MAC address of the router. The argument dump*.cap enables aircrack-ng to read all the files that airodump-ng created in the current directory, which you can see by entering the command ls . If aircrack-ng fails to recover the passphrase, it will tell you and give a recommendation for the number of packets it believes it will need to make a guess with 100% certainty. A WEP passphrase of hello took nearly 15,000 packets to crack, but once aircrack-ng had these at its disposal, the whole process took 10 seconds. With 30,000 packets, this time dropped to just four seconds.

So, now that we have the passphrase to the WEP router, we 've compromised it to the point where we can join the network from Windows just like any legitimate user. Once joined, open a command prompt and type the command ipconfig to check your network connection.

You can surf through the compromised WEP network, use a network mapping utility like our old friend Zenmap (**nmap.org/zenmap**) to find other computers on the network, and in some cases, even mount network shares to read the information they contain or deploy a network traffic sniffer to possibly capture some username/password pairs. This is why WEP security is no security. If, during this tutorial, you discover one or more WEP-protected networks in your vicinity, it would be illegal to hack them, but the act of a good neighbour would be to knock on the door and help bring the owner into the 21st century.

HARDWARE

Wall-mount your PC

Really put your hardware on show – shove it on the wall.

YOU'LL NEED THIS

Perspex sheet. We've gone for a 600 x 500 x 4mm sheet of Perspex. It's strong enough and doesn't break the bank. As we'll show, though, you need to watch your components.

M3 screws and nuts. The easiest way to mount most kit is to grab a bunch of 12mm M3 screws. These are the standard size for motherboards and the rest of your kit — 25 should do.

Long cables. Not such a challenge for your display cables, but you may need to invest in longer power, USB and keyboard cables. All these cables are usually available cheaply from eBay.

COMPONENTS

2x PCI-E x16 riser extension cable
1x 600 x 500 x 4mm Perspex sheet
25x M3 12mm bolts
25x M3 washers
100x M3 nuts
4x angle brackets
6x flat screws and rawl plugs
6x large washers
6x spacers
25x 20mm screws
25x 10mm screws

Here at *APC* we've covered all manner of hot mods and crazy cases. So when we came across not so much a mod as a new way of life – OK, a way of wall-mounting a PC – we were all on board. We stumbled across the original project when it was posted to Reddit back in 2011: it simply showed a running PC hung up on a wall. Take a look yourself at **tinyurl.com/2uqdyra**.

SINCERE FLATTERY

We felt a strong urge to try to emulate this trick and our slow-firing neurons took to calculating just how we could levitate such a contraption into the air using *APC* pocket money.

While the original system seemed to be mounted on a metallic-style board, we decided to avoid anything metal-based. First for cost, second for weight and last because we hear computers aren't too keen on short circuits.

Having played with Perspex/acrylic sheeting quite a lot, we knew it could be cheap enough and rigid enough, but would it take the temperatures that PC components throw out? A quick scout around showed Perspex starts to lose its mechanical rigidity between 95°C and 120°C, and starts to melt at 160°C.

As only top-end processors have thermal output of 135W, with the vast majority being 95W or far less, for most systems this should be absolutely fine. We wouldn't suggest you run overclocked systems on such a mounted system; again, simply because a 95W TDP processor, such as the Core i5-2500K, can have its temperatures raised greatly. Graphics cards are a different beast, but again, we'd be wary of mounting a graphics card with a TDP over 200W, as load temperatures can start reaching the 80°C level.

When it comes to the rest of the components, temperature won't be an issue. The fact of the matter is we're also going to leave clear air between components and the Perspex, so there's no chance of the Perspex meeting this type of temperature.

But it's best to play out the worse-case scenario here. We shouldn't overlook that this is also going to be mounted vertically, which we've been told is better for cooling as it encourages better convection.

Ideally, we'd suggest 5mm Perspex sheeting. You can get away with 4mm, but there's a little more flex to it with sheets this size. To fit the various components to the sheet we're going to use 15mm M3 screws and a bunch of suitable bolts. We considered using the standard

KNOW YOUR WALLS

Before you screw anything to the wall make sure you get permission from the home owner. We also demand that you get the correct type of securing wall plugs for your type of walls.

WHAT'S IN A SCREW?

It turns out one size doesn't fit all. Starting off this project we hoped to get away with a single size of M3 screw. We ended up with a pack of 25 20mm M3 screws as well as a bag of nuts and washers. It seems that bigger may be better — with a bit of spacing out with extra nuts, these could be made to work on most components. For the brackets and the PSU, however, it was better to use 10mm M3 screws — this enabled us to hide the brackets out of sight, with the screws ending up flush. Using 12mm M3 screws for the motherboard and drives would fit a lot better, but having the flexibility of the larger screws is helpful. For the PSU we'd feel better if we'd also opted for the larger 39mm two-screw hole brackets.

brass motherboard stand-off posts, but fixing these to the Perspex would either be too elaborate (using multiple screws) or not secure enough (screwing them directly into the Perspex sheeting).

SILVER FRIENDS

Just as a towel is essential for hitchhiking around the galaxy, the trusty M3 screw is the standard-issue case fixing for most PC components. These little silver friends are going to be ideal for the hard drive, optical drive and the motherboard. Both the drives provide alternative base-fixing holes. All you need to do is add a spacing washer or bolt and these are simple things to attach.

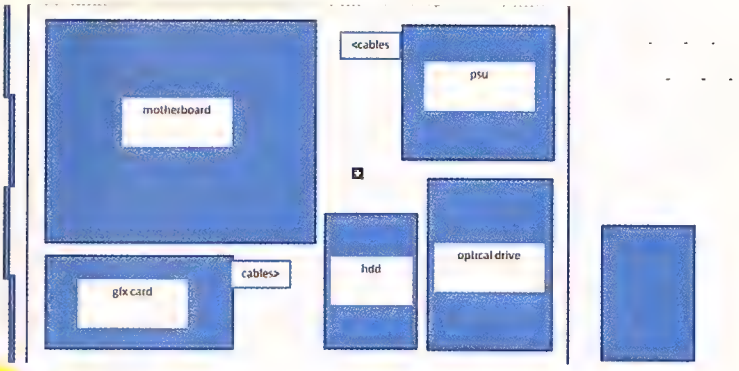
The only curve ball is when you come to fixing the power supply. Through some oddity of design, it's often the only part that requires the alternative US-based standard 6-32 UTS (Universal Thread Standard) screws. These are the case screws with the coarser thread. As these are only used on the PSU, our plan is to use 90° brackets to fix the PSU in place. If they're long enough, these could be angled underneath the PSU to hide them from view.

The last confusion is the graphics card. You can't have this hanging out the side of the PCI-E slot, because it's just going to snap off. The solution is simple: get a PCI-E riser extension ribbon cable. You might be worried about latencies, but for a signal travelling near the speed of light, a foot of extra cable is just a nanosecond. You'll find 15cm ones on eBay, but you'll need two for a long enough strip, otherwise the card would end up being mounted fan-side down.

As for fixing the thing to the wall, this is the only area that concerns us, as Perspex, while resilient to impact, can be brittle under the wrong circumstances, such as twisting and compression. Opting for a thicker, longer screw will help ensure it stays secured on the wall and using a large washer will help spread any load. Alternatively, you could use brackets to mount the board onto the wall and hold it in place, which would eliminate any chance of damaging the Perspex.

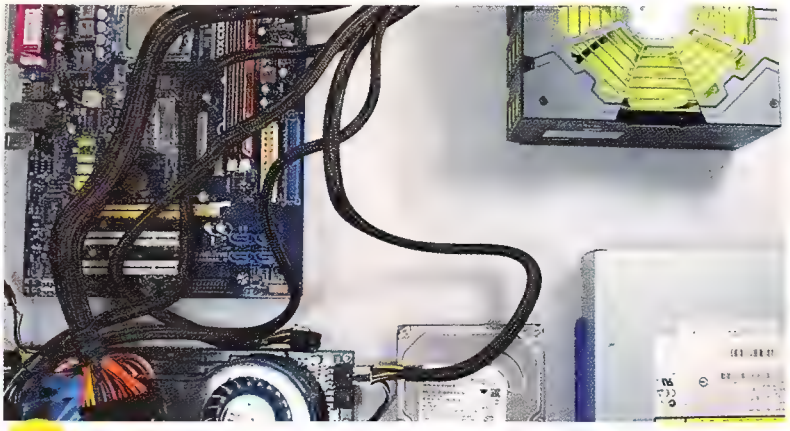
PART 1: I LOVE A PLAN

Check that your specific hardware will fit.



1 A BIT SKETCHY

First, we checked how much room our components would need. Fire up Excel and plot a quick outline over the area of Perspex you're thinking about. We used a spreadsheet with square cells marking 1cm blocks. Remember to leave enough space for the cables.



2 CABLE GUY

Keep in mind where you're going to route cables around the board, from the PSU to the motherboard, to the graphics card and the easier-to-route power and data cables to the drives. Power, monitor, keyboard and other USB cables will go from your desk to the board.

3 DRILLING HOLES

We're not anchoring screws to the Perspex — it's not strong enough. We're slowly drilling through the Perspex and using the M3 screws to fix the components, with the stress spread out and a washer at the back of the board. Make sure you drill slowly to avoid shatter.

PART 2: DRILL, BABY, DRILL

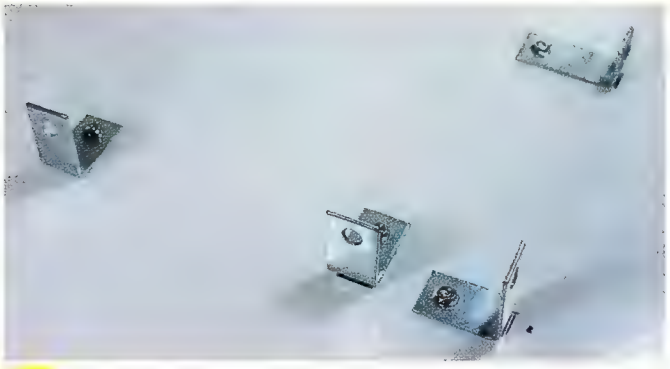
The heaviest component needs the most work.

1 FITTING BRACKETS

The PSU presents an issue on two fronts. Firstly, PSUs often use UTS screws and secondly, most only provide screw holes at one end. Of those screw holes, we can only really use the bottom two and even these aren't located at the same height, so securing this weighty item is an issue. We're going to use four 90° brackets to get around this problem.

2 POWER ON

Two of the brackets will work as supports for the 'bottom' side of the PSU. Effectively, these won't be offering a screw-based fixing, but will support the weight of the PSU, rather like a little shelf. Although we're only using 25mm brackets, you may feel you want to opt for something more secure, such as double-hole 39mm or 64mm types.



3 THE HARD ONE

It turns out 25mm brackets provide easy fittings for the higher hole, but they provide a problem for the lower. You'll need to hammer one bracket flat and then use your pliers to create a 90° bend just after the hole. If you make a mistake, don't worry too much as these things are pliable enough to be reshaped, just as long as you keep it roughly flat enough.

4 THE EASY ONE

The final normal bracket should fit the higher fixing hole perfectly, so you just need to mark off where you want it. We're placing the brackets under the PSU, but these will work either way around. We use 10mm fixing screws, along with washers and fixing nuts. However, standard case screws should also be just fine for fixing the PSU into place.

THE WALL

We love this as something new to try. If you like showing off your hardware, why shouldn't it go on the wall? Modern systems are works of art in their own right, or if you want to start a sub-cult devoted to technology, it's a suitable place to start for that new altar. Exposed wiring isn't for everyone — it's quite safe but may cause mild panic attacks in certain people. However, the stout of heart should feel happy proudly exposing their arty wiring to a bewildered world. This guide is really just a start, so let your imagination run wild. You can use whatever surface you feel is suitable. Our primary goal for most of these projects is to keep costs to under $50, but you could start throwing metal-style sheeting and lighting kits for an even more attractive finish.

For people who feel that an entirely exposed PC isn't a great idea, man up and enclose the system yourself. The simplest solution would be to double up the sheeting and use four Perspex posts to add a top. The next step would be to buy a 60mm-wide strip of thick (at least 6mm) Perspex and box in the two pieces, cutting a hole for the bigger PSU. You could also get more creative and have the shiny mountings on show.

PART 3: ATTACHED TO YOU

How you can secure your PC to Perspex.

1 MOTHERBOARD MOUNTING

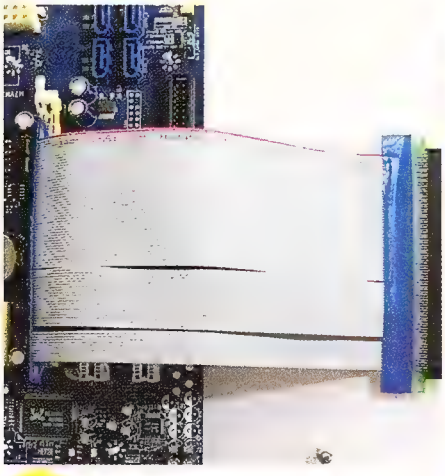
We're taking a simple approach with the motherboard. Lay it out on the Perspex and mark its mounting points. You should use at least six points. Drill 3mm holes in the Perspex so you can then push through the M3 screws with a washer. Ideally, use three nuts as posts to raise the board off the Perspex and finally, attach it in place with yet another bolt.

2 HARD & OPTICAL DRIVES

Both hard drives — solid or spinning — and optical drives offer mounting points in the base of the drives. Luckily, this means it's possible to screw your drives directly to the Perspex. You'll need to cut away part of the protective covering, but you'll be able to place the drive face down and mark off where it is that the fixing hole will need to go.

3 SPACE OUT, MAN

We'd certainly recommend leaving a similar amount of space under each drive, just as we've done with the motherboard. If you're using the longer M3 screws, you can add a nut to the outside of the board — as well as a couple for raising the drive — along with a couple of washers. Most drives will happily accommodate 8mm of thread, so it's not difficult to use up.

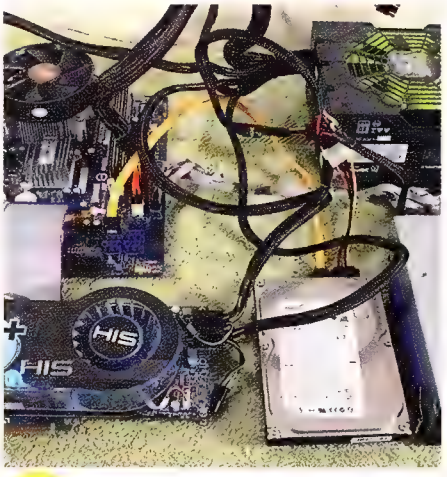


4 FLEXIBLE FRIEND

Unless you're running onboard graphics, you're likely to run into an issue with the graphics card — it's simply too heavy to leave in the PCI-E slot without additional support. Thankfully, you can buy ribbon PCI-E riser cables, which enable them to be installed away from the motherboard. You'll need around a 30cm one; alternatively, here we've used two 15cm ones.

5 VISION ON

You could use a single 15cm ribbon, but this ends up with the graphics card being fan-side on the Perspex. Unless you can mount it off the board, that's going to cause major cooling issues. Be careful when you're manipulating these, too, as the solder points aren't the strongest things in the world (we managed to unseat one while we were mucking about).



6 MOUNTING ME

When fixing this to your wall, it's easier to do it with the heavy components removed. You'll need to use your common sense here, sourcing suitable fixings for your walls along with a spacer to lift the board off the wall. We'd drill holes at least 20mm in from the edge and we'd consider either a central fixture or two central additional ones.

Diablo III

You can't dine in Hell until you've first dined in Nightmare.

sea.blizzard.com | **$89.95**

This is one of the few franchises that shaped my upbringing. I can't tell you how many hours were spent click, click, clicking away through randomly generated dungeons for the sake of all that's good in the world. That and loot; an imperial tonne of loot. It's been just over a decade since Blizzard's last serving with the *Diablo II* expansion, *The Lord of Destruction*, and half that since my last playthrough. It's finally time to get back to the grind. *Diablo III* takes place 20 years after the close of the previous game. The minions of Hell have discovered a way to resurrect the Prime Evil Diablo and it's up to you (the Nephalem) and a fallen angel named Tyrael to defeat him. There's nothing too deep or engaging about the plot, but it serves well enough as a vessel for the action.

For those unfamiliar with the series, *Diablo* can be summed up in only a couple of words: grind and loot. Players assume the role of a hero and plunge headlong through (mostly) random landscapes and dungeons overflowing with the minions of Hell begging to be vanquished. There are five character classes for players to choose from, which adhere closely to the classic archetypes for the fantasy genre: Barbarian (meathead with weapons), Wizard (magic user), Demon Hunter (ranger), Monk (martial artist) and Witch Doctor (necromancer or summoner). Unlike its predecessors, *Diablo III* places a far greater focus and complexity on building and characters' play style individuality through its skill-based combat system. There are a bank of level-gated skills available that can be changed as often as you like and lend far greater flexibility and approachability. For example, a Witch Doctor might focus on pets and AOE damage output while playing solo and mob grinding, then switch to single target damage and mana regen for boss fights, and finally focus on buffs and crowd control in multiplayer. We're no longer bound with spent ability skills and the inflexibility of old ways.

Casual players will probably dismay with *Diablo III*. The series is, and always has been, a seriously hardcore grind and the difficulty gatings only serve to amplify that. To get through to the Inferno setting and start raking in the phat loot, you'll first need to bang through Normal, Nightmare and Hell. That's finishing the game three times before it starts to get *really* good. And that's on a per-character basis, too, so if you plan on seeing a Demon Hunter, Wizard *and* a Monk reach full potential, we foresee a few sleepless nights ahead.

One-click multiplayer is exceptional, with players literally clicking one button to not only seamlessly join their friends' game, but bump the difficulty of the enemies to match. While that doesn't extend beyond core difficulty levels, getting four players together and hitting some dungeons is great fun.

We just can't shake the feeling that Blizzard was a little shy when it came to fully fleshing out *Diablo III*. The more robust the systems in place, the more it starts to resemble a light version of WoW, and we're fairly certain cannibalising players from their own subscription-based model isn't great for business. Overall, *Diablo III* really is what you make it. You can skim through Normal mode then put it down moderately satisfied, or you can start looking deeper, grinding through the difficulties, tweaking builds and, well, you get the idea. It's not for everyone, but we absolutely love it!

Troy Coleman

✔ Lengthy and deliciously grindy, massively single player campaign with drop-in-and-out multiplayer.

✖ Always-online DRM, need to get every character through the difficulty levels to unlock them, requires a massive time investment to make the most of it.

9/10

IN DEFENCE OF 'ALWAYS ON' DRM ... NOT REALLY

Hate it all you like, but businesses wouldn't be around for long if they didn't furiously protect their assets. Giving your stuff away for free might fill a Grinch's heart with joy, but it won't fill any vault swimming pools very quickly. I can't tell you the number of hands my *Diablo II* disc passed through. *Diablo III* features an 'always on' DRM that requires players to maintain constant internet connectivity with **Battle.net** — basically the same requirement as *World of Warcraft* and *StarCraft II*.

We wholeheartedly wish that an offline single-player campaign option was available. It would extend the game's reach as well as its accessibility to new players but we (mostly) understand Blizzard's motives.

We sat down during Aussie primetime on a number of occasions, only to have the logon servers unavailable due to maintenance. It's more than frustrating, it's downright obnoxious. Looking at the big picture, no Massively Single or Multiplayer games have had great launches. There'll always be a teething period.

When it works as intended, however, it's fairly unobtrusive and not *too* bad. It's not likely to suck your monthly quota dry either; in fact, we managed to get a solid connection while playing on a notebook via tethered 3G... while travelling on a train through the greater Sydney region.

Fable Heroes

Something of a mythed opportunity.

lionhead.com/fable-heroes ✧ **800 MS Points**

Fable Heroes has a pleasant enough premise; take the hero dolls from *Fable* and drop them in a *Gauntlet/Castle Crashers* (delete depending on your age/ frame of reference) type hack-and-slash adventure, with a strong multiplayer focus. It's not really worth playing by yourself and really pretty tepid over Xbox Live; the fun is having another player in the room with you when you steal all the gold, after all. Everything is cute and pleasant – and players with younger kids might appreciate the family mode – but in best *Gauntlet* tradition, there's a fierce balance between co-operation and competition. A light RPG element allows you to level up your character at the end of each level, based on how much gold you've got, and 'dead' characters can still fight, but not collect gold. This creates a strong impetus to mess with other players, although that's not all that easy, thanks to the camera, which never quite picks a friendly angle for all players. It's very dynamic and shows off the lovely *Fable* backdrops well, but that's not the same thing as helping the gameplay along because it chose to focus on a twist in the road rather than the horde of Hobbes hacking away at your health. It somewhat doesn't matter anyway because this is a button-mashing hack-and-slash game with very dodgy collision detection; you'll find yourself pummelling buttons to slay countless Balverines, only to find yourself missing for ill-defined reasons. If you're really keen, the coins collected in *Heroes* will also be transferable to the upcoming Kinect-controlled *Fable: The Journey*. Still, *Fable Heroes* is a middling title; it's easy to see the kind of game Lionhead tried to produce, but *Fable Heroes* falls very short.

Alex Kidman

- ✔ Cute, easy for kids to pick up, nice spin on *Fable* concepts.
- ✖ Insanely repetitive, dodgy camera, imprecise controls.

5/10

GRATS

PLANTRONICS GAMECOM X40 WINNERS

So to win one of two GameCom X40 headsets, all I asked of you was what radioactive animal you'd want to be bitten by and what superpower you'd gain from the transaction. I was hoping you'd get a little freaky with it and I wasn't at all disappointed. But there can be only one winner, wait no, two winners and they are: *Tobias Smith* who'd be bitten by a rad-dolphin and gain the dolphin dialect to help defuse the hostile and awkward situations he always seems to fall into, and *David Hills* who's humble mongoose powers grant him the speed of a coiled pen spring grasped too tightly between two fingers and the fatal stare before unleashing the all-out frontal spider monkey attack. Grats guys.

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8/10

PANDEMIC 2.5

@ iOS
$ $0.99

You can't know happiness until you've known sadness and genocide would be right up there on the list of sad stuff. So following some fairly thin logic, you can't know true happiness till you've committed genocide. Weak I know, but *Pandemic 2.5* is just so damn fun that I'll rationalise it any way I can. The idea is simple: create a disease (bacterial, viral or parasitic), unleash it on the world and kill off as much of the world's population as possible. You can mutate your disease along the way with symptoms such as bloating, cysts and fever among many others, each incrementally making 'Troy's Pants' (or whatever you choose to name it) more infectious, notorious and ultimately lethal. Be sure to take full advantage of trade ships, and flight and border crossings to unleash the disease as swiftly as possible, but be aware that the more notorious Troy's Pants becomes, the quicker science will develop and distribute a cure. It's a bit like watching zoomed-out Google Maps while doing some number crunching and spreadsheeting, but once you get going, it's actually quite fun. ***TC***

Prototype 2

Look out Heller Skelter.

www.prototypegame.com $99.95 consoles

The first *Prototype* suffered a little, primarily due to its release timing in that it hit almost simultaneously with *InFAMOUS*. Both titles featured free-running, open-world action, featuring a Joe Shmoe protagonist with inhuman abilities. The similarities were just too similar not to compare and for our money, *Prototype* was outclassed on every level. This time around, players take on the role of Sergeant James Heller, a veteran soldier whose family was killed by the Mercer Virus. Or so he was led to believe. He tracks Alex Mercer to the 'Red Zone' (the region of New York most devastated by the virus) for retribution, but instead learns Mercer wasn't responsible after all. Mercer infects Heller, thereby granting him super-human abilities and makes him his pawn in the fight against the true enemy, Blacklight. *Prototype 2* retains the same open-world, mission-based style of play as the first, with players encouraged to explore the landscape and cherry-pick missions while destroying almost everything. Mutant claws, hammerfists, bio-bombs and the much-improved tendrils flesh out the primary biological barrage at Heller's disposal, with a few additional pet tricks and traditional weaponisation options available mid to late in the game. Against that much inhuman stopping power not much can – or does – stand in Heller's way and unless you play incredibly recklessly, the entire affair quickly becomes monotonous, repetitive and downright boring. The underlying problem with *Prototype 2* is that it's not terribly ambitious. It's taken what was an average first game, tightened up the controls, polished up the production and presented it back to us in some fresh packaging. It's not going out of its way to impress us. There's some fun to be had for fans of the series and new players alike, but just don't go in expecting a memorable experience.

Troy Coleman

✔ Controls feel superior to the first game.
✖ Feels like an update.

7/10

RE: Operation Raccoon City

Waggle the A key not to die...

www.capcom.com/us/
$109.95 for PS3/Xbox, $59.95 for PC or US$49.99 for PC via Steam

Resident Evil: Operation Raccoon City (REORC) is a new spin on the franchise, eschewing the classic survival horror model for some four-player co-op. The story takes place alongside RE2 and 3, following a team of psychotic soldiers called Wolfpack, who work for the Umbrella Corporation. By having six playable characters in a four-player game, all banter and character interactions during the missions were poorly fleshed out and largely unresolved. Each character had unique abilities and could choose their weapons from a vast pool, which were unlocked by experience gained from missions. This system worked well and allowed for genuine variety. That was the best we could hope for from what is essentially a terrible PC port of a console game. The development laziness shone from the first mission's boss encounter when a quicktime event popped up prompting us to waggle the A key not to die. Among other similar quirks, the inventory selection showed a D-pad for navigation. Pathetic. Gameplay was mostly mediocre. For example, the cover mechanics weren't well developed, and poor teammate and enemy soldier AI was also exasperating. Level design was interesting enough, but cover often felt tacked on and the abundance of supplies was often incongruous. One irritating quirk was no animation when reviving teammates and a common glitch was gun sound switching off. While we didn't get to try multiplayer, it as least seems respectable on paper. There's four-on-four deathmatch, capture the flag, a race to a rescue helicopter and Heroes, which pits former RE protagonists against former RE antagonists. REORC could've been great, but lazy design undermined everything good on offer.

Conrad Bem

✔ Engaging boss fights, skill and weapon variety.
✖ Sloppy console porting, flawed character interaction, stunted cover mechanics.

6/10

123 chip chat

SIMON CHESTER

YOU WILL NEVER FIND A MORE WRETCHED HIVE OF SCUM AND VILLAINY

STAR WARS MICRO RECREATES ARCADE GLORY IN MINIATURE

Once upon a time, during the heyday of arcade glory, there was a *Star Wars* arcade game like no other. From the spaced-out cabinet to the delicious quasi-3D graphics, this game had it all. Many a child's pocket money ended up disappearing down that tunnel.

So, in the name of gaming nostalgia and all things gloriously tiny, **arcadecontrols.com** forum user Le Chuck decided to recreate that wondrous machine in 1:6 scale.

Totalling 80 hours' work, the 12in replica, dubbed Star Wars Micro, is a GPH Caanoo (Linux-based handheld gaming console) miniature arcade with what the creator claims is the first ever, fully working miniature Atari Yoke (the control stick you see in the image) running the Multiple Arcade Machine Emulator, MAME4ALL.

You can read more about it, and see more images and a video at **tinyurl.com/6mofr4k**.

GOOGLE, AS SEEN THROUGH BBS

Do you remember BBS or Bulletin Board Systems? They were the early, dialup, ASCII-tastic versions of the web, where users would log on to message other users, read news or exchange (very small) software.

Well, if you're hankering for a taste of the past, or perhaps you're a fan of the old-meets-new mash-ups that are so popular these days, the fellows over at mass:werk have put together a version of Google that emulates the feel of those BBS days of yore, complete with the screechy tones of dialup data transfers.

Just like with the real Google, you can search for anything you want, with the results displayed in a retro-tastic, keyboard-only, white-on-black ASCII interface.

Go check it out at **www.masswerk.at/googleBBS**.

ANCIENT DROP BEAR DISCOVERED

There's no more elusive Australian marsupial than the drop bear. No living specimen has ever been seen, yet education campaigns countrywide warn travellers to remain diligent while underneath trees and to spread vegemite across their skin as protection.

However, a recent fossil discovery in the Riversleigh World Heritage Area in north-western Queensland shows that such a large, tree-dwelling marsupial existed in the past.

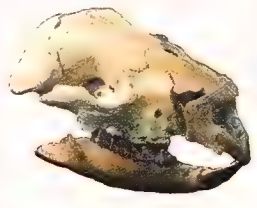
How large, you ask? The fossils show a diverse range of sizes and ages, but the largest was about seven times the size of a koala and weighed 70kg.

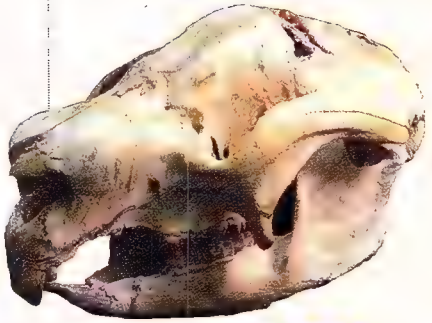
To avoid being confused with its modern counterpart, the new creature has been dubbed the 'Nimbadon' and is thought to have lived in groups in rainforest canopies around 15 million years ago.

Unlike the drop bear, the Nimbadon was herbivore and formed part of the group of marsupials known as diprotodontoids.

Beyond just helping understand the physiology of these ancient beasts, the fossils can also be used to gauge environmental conditions, such as the type of vegetation in Australia at the time, as well as the climate.

Dr. Karen Black from UNSW recently received the 2012 Dorothy Hill Award for female researchers in the Earth sciences from the Australian Academy of Science for her work with the fossils.





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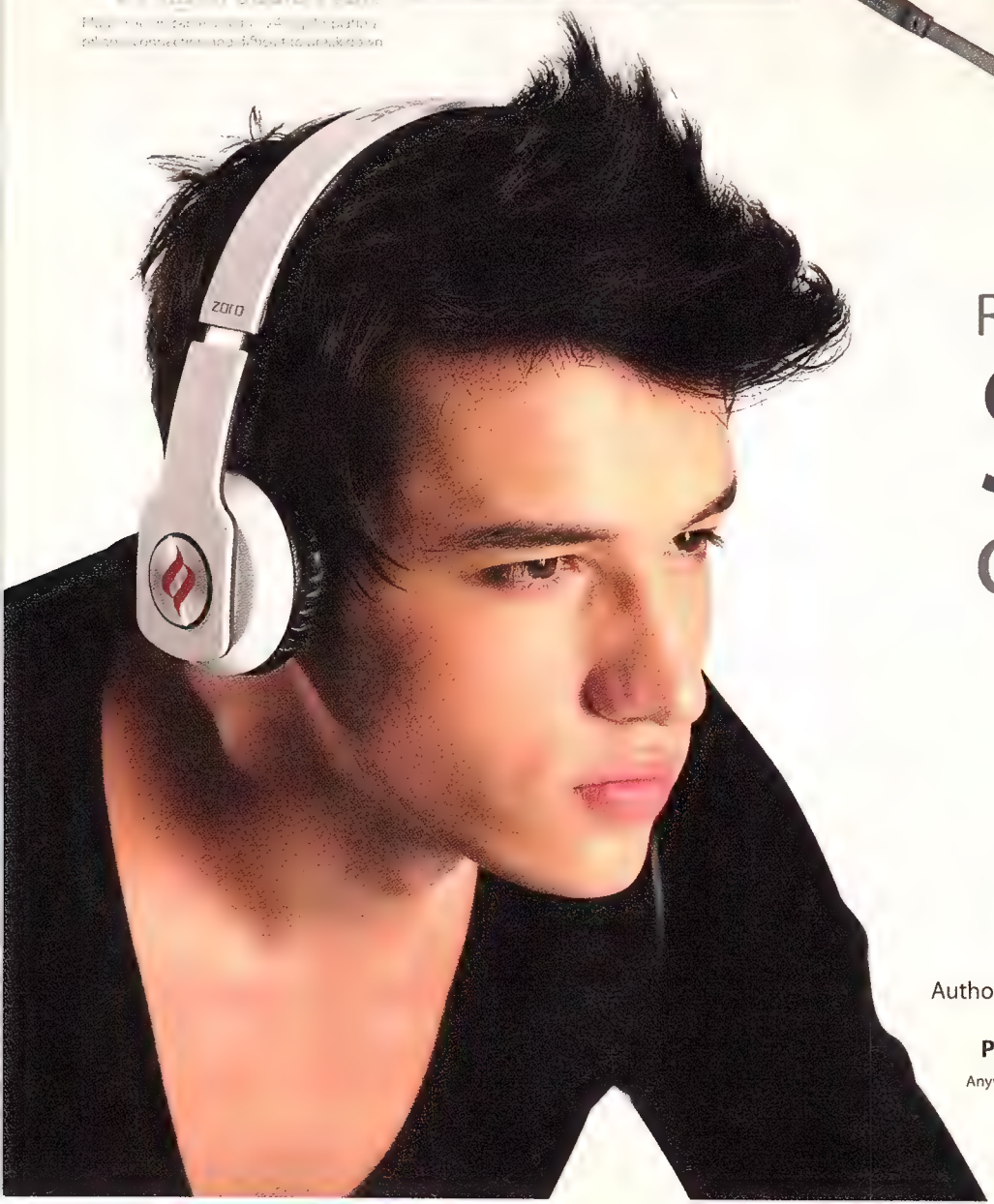

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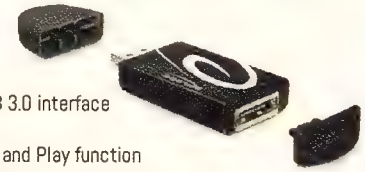

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Telecommunications Solution

SAVE MONEY • IMPROVE EFFICIENCY • ADD A PROFESSIONAL TOUCH

FAXSTREAM DUET AND FAX SWITCHES

- Duet Switches for Home or Business
- Fax Switches for Home or Business
- Save rental costs for a separate fax line
- Easy user installation

DOOR PHONE INTERCOM FOR HOME TELEPHONES

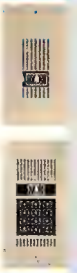
- Will ring all Telephones, just answer to talk
- Works with Cordless Phones
- Can open Doors or Gates
- Can dial out to Cell Phone
- Home Automation Integration

DOOR PHONE INTERCOM FOR ANY PABX

- Extension Connect
- Trunk Connect
- Can open Doors or Gates
- Video and Keypad options
- Touch tone dialing

CHOICE OF MULTIPLE INTERCOMS

- Marine Grade Stainless Steel
- Touch Switch Activation
- Flush and Surface Mount
- Video Camera options
- Keypad Entry options



MESSAGE ON HOLD FOR ANY PABX

- Digital Message On Hold
- MP3 files stored on Flash Card or in memory
- Automatic Message Updates or Timed changes
- Optional After Hours Announcement

MESSAGE ON HOLD FOR SINGLE LINES

- Operates with standard phones
- Operates with cordless phones
- Optional Call Attendant facility
- Optional After Hours Announcement

BACKGROUND MUSIC AND MESSAGING

- Up to 4000 songs on SD Flash Card
- Intelligent Messaging or Music only
- Integrated Amplifier
- Instant Message on Demand

DIGITAL AUDIO FOR MESSAGING or PROMOTION

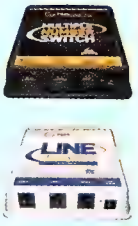
- Up to 250 messages on SD Flash Card
- Switch or PIR activation
- Timed Activation
- 1-12 separate inputs 1-12 separate outputs
- Powerful 8W amplifier

MODEM SWITCHES EFT-POS SWITCHES

- For Dial Out Modems
- For Dial In Modems
- Multiple Modem Switch
- Eftpos Switch
- Two Line Eftpos Switch

TELEPHONE LINE SWITCHES

- Privacy Switch
- Barge In Switch
- Multiple Number Switch
- Two Line Switch
- Custom Solutions



CONTROL EQUIPMENT BY TELEPHONE LINE

- Switch Power ON or OFF Reset Power
- Touch Tone Controlled Relays
- PIN Security option
- Share your line with FaxStream Duet or Multiple Number services

CONTROL ACCESSORIES

- 240V Power Switches
- Normally ON or Normally OFF operation
- PC Reset unit
- Easy User Installation

CALL RECORDING FOR PABX OR SINGLE LINES

- Single Line Model
- PABX Handset Models
- PC based software
- Record and Playback
- Easy User Installation

PABX ACCESSORIES

- Paging Switches
- Automatic Call Attendant / Automatic Announcement Device
- Door Stations
- Message On Hold
- PABX Fax Switch

TELEPHONE LINE ACCESSORIES

- Ring Indicator
- Line In Use Indicator
- Ring Booster
- Telephone Call Transfer
- Telephone Line Monitor
- Telephone Auto Dialler

TELEPHONE LINE SIMULATORS

- Ideal for Test and Demo
- Australian Dial Tone and Ring
- CallerID output option
- International Models for 22 seperate countries

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- Intel® Z77 Express chipset
- Support Intel® Core i7 socket 2011 CPU
- Support 4x DDR3-1600 Dual Channel (Max 32 GB)
- 2x SATA 6Gb/s and 2x SATA 3Gb/s, 1x external SATA,
- 2x mini-PCIe(1x short, 1x Long), 5x Audio output for 7.1 CH, SPDIF output, 4x USB 3.0(native), 6x USB 2.0,
- 1x DVI-I connector, 1x HDMI connector,
- 500W, 80 PLUS BRONZE
- optional: RS232 COM Port, WLAN module 802.11n
- Dimensions: 332(L) x216(W) x196(H) mm

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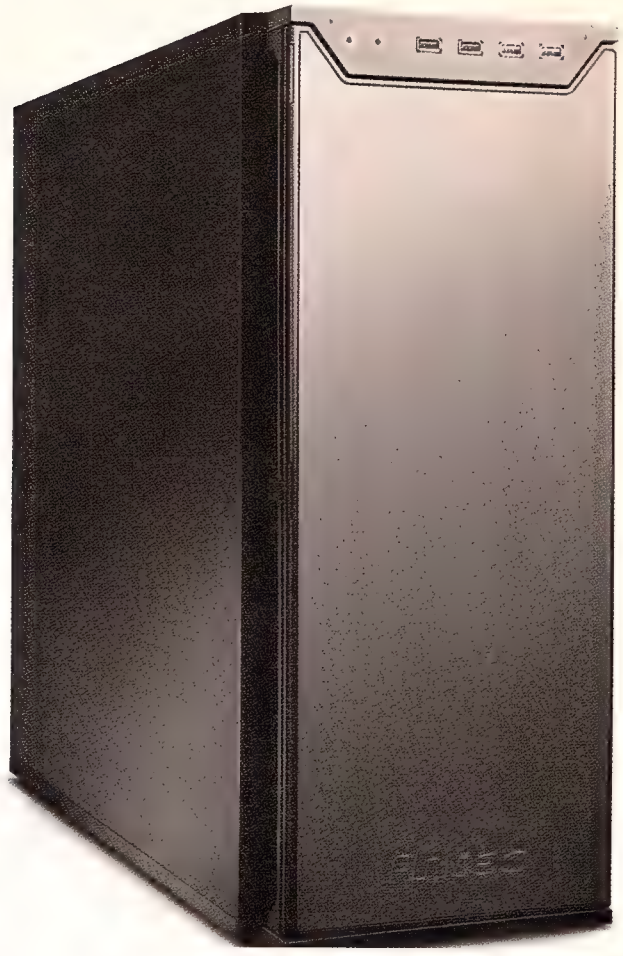

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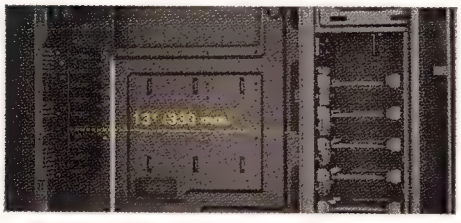
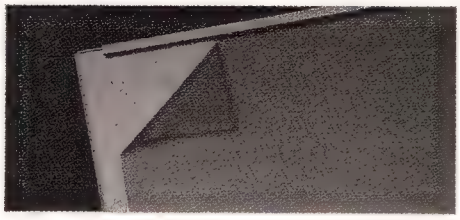
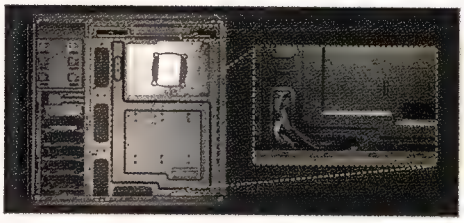
EASE OF USE

Grommet-lined cable routing holes with 30 mm of space behind the motherboard tray







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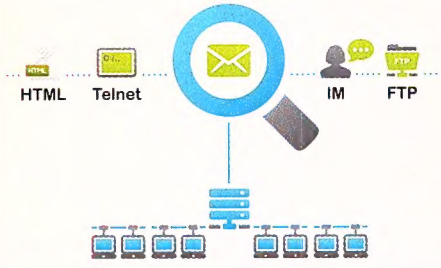

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- Triple-WAN bandwidth management with Load Balance and redundancy
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- 4-port Gigabit switch with 4 VLANs (802.1q), each is Port or IP based and has own VLAN Prioritization
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- QoS (Layer 2&3, 802.1p & TOS/DCSP) for prioritizing video, voice, online game and data traffic
- 32 x VPN tunnels with 3DES hardware accelerator
- USB 2.0 for 3G / 4G USB Modem, FTP and Printer Server
- Support 802.11n Single-Band 2.4GHz Wireless (n & Vn models only)
- Support 802.11n Dual-Band 2.4/5GHz Wireless (n+ & Vn+ models only)
- LAN with Wireless Guest Portal & Wireless VLAN (Wireless models only)
- VoIP and PBX functions (VoIP models only)
- Support TR-069 for VigorACS SI
- Support Smart Monitor up to 30 users

	Vigor2830	Vigor2830n	Vigor2830n+	Vigor2830Vn	Vigor2830Vn+
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Dual-Band Wireless			◉		◉
VoIP				◉	◉

VigorIPPBX 2820 series

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- IP PBX up to 50 extensions and 6 SIP trunks
- 1 x FXS for telephone handsets and 1 x FXO for PSTN line
- Advanced IPPBX functions: Auto Attendant/IVR, Hunt Group, Voice Mail, Digit Map, DID, Call Parking/Forward, and so on
- Built-in ADSL2+ modem & additional Ethernet, 3G /4G WAN port
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- 4-port switch with 1 x Gigabit and 3 x 10/100Mbps ports
- Object based SPI Firewall with DoS Defense, Content Security Management (CSM), Web Content Filtering (WCF)
- QoS for prioritizing video, voice, online game and data traffic
- 32 x VPN tunnels with 3DES hardware accelerator
- USB 2.0 for 3G / 4G USB Modem, FTP and Printer Server
- LAN with Wireless Guest Portal & Wireless VLAN (Wireless models only)
- Support 802.11n Wireless (Wireless models only)
- Support TR-069 for VigorACS SI
- Support Smart Monitor up to 30 users

	VigorIPPBX 2820	VigorIPPBX 2820n
Wireless AP		◉
VoIP		◉

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